PLAN FORMULATION APPENDIX

1.0 INTRODUCTION

This appendix provides supplemental plan formulation information for the Southwest Coastal Louisiana feasibility study. It supplements the information in Chapter 2 of the main report and includes tables used in the initial and intermediate development, screening, and evaluation of management measures, features, and alternative plans. The formulation process from the development of the NED and NER focused arrays through the identification of the NED and NER Tentatively Selected Plans is fully documented in Chapter 2 of the Main Report.

Universe of NED & NER Features: The initial set of concepts for consideration under the Southwest Coastal feasibility study was inventoried from multiple sources as shown in figure 1. Since concepts were pulled from multiple sources, some concepts did not meet the definition of a management measure, and in some cases the same concept or measure was repeated more than once (for example if it appeared in both the State Master Plan and the LACPR report) so duplicates had to be removed. Only measures that met the following criteria were carried forward into the initial array of features:

- Meets the definition of a feature ("a project or an activity that can be implemented at a specific geographic site to address one or more planning objectives");
- Not part of the future without project condition;
- Addresses one or more of the Southwest Coastal planning objectives;
- Doesn't violate any of the Southwest Coastal planning constraints.

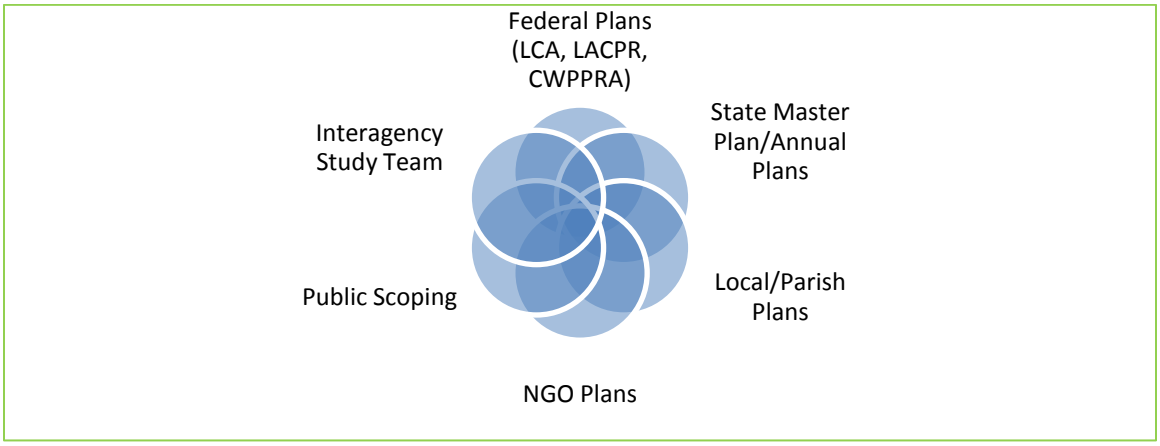

Figure 1. Sources of ideas to solve problems in the Southwest Coastal area.

After sorting through approximately 300 concepts or measures, approximately 100 were found to be unique and viable measures.

Table C-1, Initial NED and NER Features Compiled and Screened

Initial ID	Feature No.	Name/Description/Location	Source	Objective No.	Incorporated into the initial array of features?	
1	N/A	Freshwater Introduction from Sabine River to Sabine National Wildlife Refuge	Draft SMP 4-19	N/A	No	Does not address any planning objectives. CRMS data indicate the area is relatively healthy and not in need of salinity/hydrologic control.
2	N/A	Salinity control structures along the east shoreline of Sabine Lake near Blue Buck Point, Sabine Island and Black Bayou	Preliminary Draft SMP	N/A	No	Does not address any planning objectives. Modeling performed for CWPPRA project CS-32: East Sabine Lake Hydrologic Restoration indicated limited benefit from proposed structures.
3	3a1, 3c	Beneficial Use of Dredged Material from Calcasieu Ship Channel	SMP 4-13	7	Yes	The planning team reduced acreage of this measure to exclude historic water bodies, existing terraces, DMMP sites, etc. East of Calcasieu Lake the measure was repositioned to reinforce the lake rim in areas of recent land loss.
4	21a, 21b, 21c	Salinity control structures at Hwy 82	Preliminary Draft SMP	2	Yes	Duplicate of Measure #21.
5	5a	Gulf Shoreline Protection (Holly Beach reach)	SMP 4-10/ LACPR/ Cameron Parish	5	Yes	Per BICM data, Holly Beach has experienced high shoreline recession rates (~22.5 ft/yr). Pending beach nourishment project in the area will provide a short-term buffer between Highway 82 and the Gulf of Mexico.
	N/A	Gulf Shoreline Protection (Johnson's Bayou and Ocean View Beach reaches)	SMP 4-13/ LACPR	N/A	No	Does not address any planning objectives. BICM data indicate that shoreline recession rates are low. Johnson's Bayou reach has consistently been accreting since the 1880s. Ocean View Beach has been accreting since the 1990s with only minor erosion (~1.5 ft/yr) between the 1880s and 1990s.
6	N/A	Gulf Shoreline Protection (Hackberry Beach and Mermentau Beach reaches)	SMP 4-11/ LACPR	N/A	No	Does not address any planning objectives. BICM data indicate that shoreline recession rates are relatively low. Hackberry Beach has recently experienced periods of accretion (41.4 ft/yr from 2004-2005) or minor erosion (4.4 ft/yr from 1990s – 2005).
	6b	Gulf Shoreline Protection (Rockefeller Refuge reach)	SMP 4-11/ LACPR/ Cameron Parish	5	Yes	Shoreline recession is consistently highest along Rockefeller Refuge. Per BICM data, Rockefeller Refuge has recently experienced the highest recession rates in the study area (a loss of 52.4 ft/yr from 1990s to 2005).
7	7	Salinity control structures in Calcasieu Ship Channel near Ferry/at the Gulf of Mexico	Preliminary Draft SMP	2	Yes	
8	3a1, 3c	Beneficial uses of dredged material program: utilize sediment and dedicated dredging for marsh enhancement and construction of terraces near Calcasieu Lake	Preliminary Draft SMP	7	Yes	Duplicate of Measure #3.
9	N/A	Salinity control structures at points on east	Preliminary	N/A	No	Salinity control structures already exist on the eastern shore of

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Initial ID	Feature No.	Name/Description/Location	Source	Objective No.	Incorporated into the initial array of features?	
		side of Calcasieu Lake	Draft SMP			Calcasieu Lake.
10	N/A	Maximize freshwater inflow to tributaries of the Mermentau from outside sources	Preliminary Draft SMP	N/A	No	Does not address any planning objectives.
11	N/A	Maximize freshwater inflow to Mermentau from outside sources	Preliminary Draft SMP	N/A	No	Does not address any planning objectives.
12	12a-d	Stabilize Grand Lake Shoreline	SMP 4-6	N/A	No	Measure was investigated. Areas of existing shoreline protection (i.e. the majority of the south and southeastern shorelines) were screened out. USGS analyses of other shoreline reaches showed relatively low recession rates (<2 feet per year). Therefore, this measure was excluded from further analysis because it doesn't address an area of critical need.
13	13	Freshwater introduction/retention structure or sill on Little Pecan Bayou	Preliminary Draft SMP	2	Yes	
14	N/A	Freshwater introduction/retention structure or sill on Rollover Bayou	Preliminary Draft SMP	N/A	No	Part of the future without project condition. Addressed by State project ME-01 Pecan Island Freshwater Introduction.
15	N/A	Stabilize White Lake Shoreline	SMP 4-7	N/A	No	Does not address any planning objectives. The entire south shore is protected by rock dikes whereas the north shore has not experienced significant recent shoreline recession.
16	16a	Fortify and restore banks of Schooner Bayou Canal from Highway 82 to North Prong	SMP 4-15 and Vermilion Parish	N/A	No	Measure was investigated. USGS analyses of this part of Schooner Bayou showed relatively low bankline recession rates (about 1 foot per year). Therefore, this measure was excluded from further analysis because it doesn't address an area of critical need.
	16b	Fortify and restore banks of Freshwater Bayou Canal	SMP 4-15 and Vermilion Parish	5	Yes	Banklines with existing or impending rock dikes were screened out.
17	17a	Salinity control structure on Alkali Ditch	LCA PBMO/ LACPR 5-4	2	Yes	
	17b	Salinity control structure on Crab Gully		2	Yes	
	17c	Salinity control structure on Black Lake Bayou near Hackberry	LCA PBMO/ LACPR 5-3	2	Yes	
18	N/A	Build new chamber for navigation at Calcasieu Lock on GIWW and use old lock to evacuate excess water	Preliminary Draft SMP	N/A	No	Building a new lock for navigation does not meet any planning objectives. The USACE has an existing ongoing Calcasieu Lock Replacement study. Operations of existing structures will be evaluated under Measure #602.
19	16b	Stabilize banks of Freshwater Bayou	SMP 4-8	5	Yes	Duplicate of Measure #16b.
20	49b1	Stabilize eastern shore of Lake Calcasieu	SMP 4-16	5	Yes	Duplicate of Measure #49.

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Initial ID	Feature No.	Name/Description/Location	Source	Objective No.	Incorporated into the initial array of features?	
21	21a, 21b, 21c	Hydraulic Improvements in Mermentau Basin at Highways 82 and 27 (via Hydraulic Improvement Structures)	SMP 4-20	2 & 4	Yes	Note that there are structures proposed (CWPPRA project ME-20) or constructed (CIAP project at Highway 27) that overlap with this measure. Chenier Plain Hydrodynamic model will determine best locations for additional culverts to discharge excess water and control saltwater intrusion.
22	N/A	Manage watershed to reduce rapid inflows into Mermentau Sub-basin	Preliminary Draft SMP	N/A	No	This is a planning objective not a management measure.
23	N/A	Restore marsh by filling abandoned canals	Preliminary Draft SMP	N/A	No	Although restoring marsh is a planning objective, backfilling all abandoned canals without regard to their location does not meet the objective of strategically restoring marsh and is not feasible given limited sediment resources. Also, many canals that appear to be abandoned may still serve active wells or production units.
24	N/A	Utilize freshwater inflow from Atchafalaya River: Convey Atchafalaya River Water Westward via GIWW (via Rock Dike)	LACPR PU3b 1-2	N/A	No	Does not address any planning objectives. There are significant challenges in conveyance of water due to the GIWW's relatively "porous" bankline, as well as long-term implications to Atchafalaya (and Mississippi) River operations all the way to the Old River Control Structure. This measure is not feasible or cost effective at this time because of constructability and navigation issues. This measure would be better investigated under the proposed LCA Upper Atchafalaya Basin Study.
25	N/A	Improve hydrology of the old Mermentau River Channel between Mud Lake and Gulf of Mexico	Preliminary Draft SMP	N/A	No	This measure would be difficult to implement successfully considering the proximity of the more hydraulically-efficient Mermentau River Navigation Channel.
26	26	Bankline Protection for Gulf Intracoastal Waterway (GIWW)	SMP 4-4	N/A	No	Measure was investigated. USGS analyses of the GIWW from the Sabine River to Leland Bowman Lock showed relatively low bankline recession rates (<2 feet per year for the majority of the northern bankline, and <3 feet per year for the majority of the southern bankline). Therefore, this measure was excluded from further analysis because it doesn't address an area of critical need and because of low cost-effectiveness.
27	N/A	Allow Calcasieu Lake and surrounding area to become and remain brackish to saline	Preliminary Draft SMP	N/A	No	Does not address any planning objectives.
28	N/A	Dedicated dredging from the Gulf of Mexico for marsh creation and enhancement.	Preliminary Draft SMP	N/A	No	Does not meet the definition of a management measure (doesn't meet a planning objective at a specific location). Dredging from the Gulf of Mexico will be evaluated as a potential source of material for measures.

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Initial ID	Feature No.	Name/Description/Location	Source	Objective No.	Incorporated into the initial array of features?	
29	N/A	Maintain Hwy 82 for marsh protection	Preliminary Draft SMP	N/A	No	Maintenance of Hwy 82 is a LADOTD responsibility.
30	16b	Fortify spoil banks on GIWW in St. Mary and Vermilion Parish, Freshwater Bayou Canal	LACPR 3-12	1 & 5	Yes	Only Freshwater Bayou portion of this proposed measure was carried forward. Duplicate of Measure #16b.
31	416, 509, 510	Restore Chenier Forests	Preliminary Draft SMP	7	Yes	Duplicate of Measures #416, 509, and 510.
32	149, 411, 412	Lake Charles & Vicinity Hurricane Protection (via Earthen Levee/Major Structure)	SMP 4-1	1	Yes	Duplicate of Measures #149, 411, and 412.
33	N/A	New levee alignment along Highway 82 (from Vinton to Abbeville)	LACPR Atlas PU4-H	N/A	No	This alignment did not pass the initial LACPR screening because of strong local opposition; high cost; environmental concerns such as wetland impacts and drainage problems (e.g. trapping saltwater after a storm). Based on LACPR Final Technical Report evaluations, this measure doesn't meet Federal of cost effectiveness or protecting the nation's environment.
34	GIWW	Abbeville to Lake Charles Hurricane Protection (via Earthen Levee)	SMP 4-2	1	Yes	Study authority requires assessing the "feasibility of constructing an armored 12-foot levee along the Gulf Intracoastal Waterway."
35	N/A	New levee alignment along the 10-ft contour (from Abbeville to Texas border)	LACPR Atlas PU4-C	N/A	No	This alignment did not pass the initial LACPR screening because of long length (high life-cycle costs); environmental concerns such as wetland impacts and drainage problems (e.g. trapping saltwater after a storm). Based on LACPR Final Technical Report evaluations, this measure doesn't meet Federal of cost effectiveness or protecting the nation's environment.
36	N/A	Nonstructural collaboration with local, State and Federal agencies for application of all nonstructural measures	LACPR Atlas	N/A	No	Doesn't meet the definition of a management measure, but will be identified as a multi-agency collaboration opportunity in the report.
37	601	Nonstructural incentive program to elevate above ABFE/BFE to + mean sea level for new construction and reconstruction/relocation in collaboration with other agencies	LACPR Atlas	1	Yes	Will be considered under Measure #601.
38	601	Nonstructural permanent evacuation/relocation of residential assets along Hwy LA-82 for Risk Reduction and Ecosystem Restoration	LACPR Atlas	1	Yes	Will be considered under Measure #601
39	N/A	Nonstructural technical assistance/information/workshops on	LACPR Atlas	N/A	No	Doesn't meet the definition of a management measure, but will be identified as a multi-agency collaboration opportunity in the

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		implementation of measures				report.
40	601	Nonstructural ringwalls/berms surrounding private property	LACPR Atlas	1	Yes	Will be considered under Measure #601
41	601	Nonstructural flood proofing critical facilities and critical economic assets	LACPR Atlas	1	Yes	Will be considered under Measure #601
42	149, 411, 412	Lake Charles and Vicinity Hurricane Protection	SMP 4-1	1	Yes	Duplicate of Measures #149, 411, and 412.
43	N/A	Abbeville to Lake Charles Hurricane Protection	SMP 4-2	N/A	No	Doesn't meet Federal objective of cost effectiveness based on LACPR Final Technical Report evaluations. Also, high environmental mitigation costs.
44	TBD	Raise and Maintain Highways 82 and 27	SMP 4-3	1	No	To be evaluated with ADCIRC modeling to determine if risk reduction measures can be formulated (e.g. raising low parts of the highway, rock armor in select areas, etc). Maintenance of Highways 82 and 27 is a LADOTD responsibility.
45	N/A	Restore the Mermentau Lakes Basin Integrity	SMP 4-5	N/A	No	This is a goal not a measure. See Objectives 2, 3, and 4.
46	7	Salinity Control Structure at Calcasieu Pass	SMP 4-9	2	Yes	Duplicate of Measure #7.
47	47a, 47c, 47f, 47h	Marsh Restoration Using Dredged Material South of Highway 82	SMP 4-12	7	Yes	The planning team reduced acreage of this measure to exclude areas with existing or planned terraces, areas that Rockefeller Refuge uses for duck research, etc.
48	48	Salinity Control Structure at Sabine Pass	SMP 4-14	2	Yes	Changed measure to be a sill or rock dike closure between the Sabine Navigation Channel and the marsh in Cameron Parish just north of highway 82. However, the ship channel is open to Sabine Lake at the north end, so the benefits of the sill probably will not be as effective as if the system was isolated from the ship channel. In fact, the sill could exacerbate issues on the north end by increases in differential stage levels within the lake.
49	49b1	Stabilize Calcasieu Lake Shoreline	SMP 4-16/ Cameron Parish	5	Yes	Only 49b1 portion of this measure (i.e., shoreline in front of the Cameron-Creole Watershed) was carried forward because USGS analyses of other shoreline reaches showed relatively low recession rates (about 2 feet per year).
50	N/A	Stabilize Sabine Lake Shoreline	SMP 4-17	N/A	No	USGS analyses of the Sabine Lake shoreline showed relatively low recession rates. Therefore, this measure was excluded from further analysis because it doesn't address an area of critical need.
51	N/A	Mermentau Basin Watershed Management Plan to Retain Freshwater Resources	SMP 4-18	N/A	No	Does not meet the definition of a measure; however, measures consistent with this plan may be formulated pending the results of the Chenier Plain Hydrodynamic model.

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Initial ID	Feature No.	Name/Description/Location	Source	Objective No.	Incorporated into the initial array of features?	
52	N/A	Chenier Plain Freshwater and Sediment Management and Reallocation	LACPR 5-17	N/A	No	Does not meet the definition of a measure. The LCA "Chenier Plain Freshwater and Sediment Management and Allocation Reassessment Study" has not been funded; however, some ecosystem restoration concepts are being evaluated as part of the SW Coastal feasibility study.
53	GIWW	To evaluate the GIWW alignments in Planning Units 3b and 4	LACPR Atlas	1	Yes	Duplicate of Measure #34. Authority requires assessing the "feasibility of constructing an armored 12-foot levee along the Gulf Intracoastal Waterway."
54	149, 411, 412	Hurricane surge protection for Lake Charles metropolitan area and Vinton using ring levees	Preliminary Draft SMP	1	Yes	Duplicate of Measures #149, 411, and 412.
55	141, 142, 143, 144, 34?	Hurricane surge protection from Vermilion River to GIWW/Calcasieu River Lock	Preliminary Draft SMP	1	Yes	Duplicate of Measures #141, 142, 143, 144, and 34.
56	TBD	Raise & Maintain Highways 82 and 27	SMP 4-3	1	No	Duplicate of Measure #44.
57	N/A	Proposed hurricane protection levee for 30-A storm surge at coastline	Preliminary Draft SMP	N/A	No	This alignment did not pass the initial LACPR screening for the same reasons as the Hwy 82 alignment: strong local opposition; high cost; environmental concerns such as wetland impacts and drainage problems (e.g. trapping saltwater after a storm). Based on LACPR Final Technical Report evaluations, this measure doesn't meet Federal of cost effectiveness or protecting the nation's environment.
58	N/A	Complete/accelerate the Chenier Plain Freshwater and Sediment Management and Allocation Reassessment study which was included in the LCA Near-Term Plan	LACPR 5-17	N/A	No	The LCA "Chenier Plain Freshwater and Sediment Management and Allocation Reassessment Study" has not been funded; however, some ecosystem restoration concepts are being evaluated as part of the SW Coastal feasibility study.
59	601	Develop a plan to elevate and/or relocate assets located outside the hurricane protection levee	SMP	1	Yes	Will be considered under Measure #601
60	N/A	Toll road on top of levee south of GIWW	Preliminary Draft SMP	N/A	No	Not water resources related. Does not address any planning objectives.
61	N/A	Hebert Canal Watershed	Preliminary Draft SMP	N/A	No	Does not meet the definition of a measure. See Measure #142 for Hebert Canal storm surge measure.
62	N/A	North Prong Salinity control flood protection for Mermentau Basin	Preliminary Draft SMP	N/A	No	Project constructed as part of "Schooner Bayou to GIWW." Part of the future without project condition.
63	N/A	Storm buffering systems	Preliminary	N/A	No	Does not meet the definition of a measure (no geographic area

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			Draft SMP			specified). Evaluated as part of the study.
64	N/A	Maintain Mermentau Basin as Fresh Water Basin	Preliminary Draft SMP	N/A	No	Stated as a planning objective, not a measure. See Objectives 2 – 4.
65	N/A	Cameron: Use old Calcasieu lock for flood control	Scoping	N/A	No	Duplicate of Measure #18. Change in lock operations will be evaluated under Measure #602.
66	N/A	Cameron: Need storm surge protection south of Route 82	Scoping	N/A	No	Storm surge risk reduction is a planning objective not a measure. Nonstructural risk reduction measures will be evaluated south of Hwy 82.
67	N/A	Cameron: Need beneficial use of dredged material to build levees/barriers	Scoping	N/A	No	Does not meet the definition of a measure. Levee construction methods will be evaluated if a structural plan is carried forward.
68	N/A	Cameron: Need to consolidate drainage boards by watershed for effective management	Scoping	N/A	No	Does not address any study planning objectives but will be identified in the report as a multi-agency collaboration opportunity.
69	N/A	Cameron: Need buffers/setbacks away from population	Scoping	N/A	No	Not a specific measure. Concept included in the study's multiple lines of defense strategy.
70	N/A	Cameron: Look at levee impacts on wetlands and the economy of the area	Scoping	N/A	No	Not a measure. Will be evaluated during the study
71	5a, 6b	Cameron: Erosion is a problem- need beach/shoreline stabilization along the Gulf	Scoping	5	Yes	Duplicate of Measures #5 and 6.
72	N/A	Cameron: Restore Kelso Bayou	Scoping	N/A	No	Stated as an objective not a measure. Hydrologic/Salinity Control Measure #17c would help restore Kelso Bayou. Marsh restoration is also proposed along Kelso Bayou by CWPPRA project CS-53.
73	3a1, 124a-d	Cameron: Need marsh creation west of the Calcasieu	Scoping	7	Yes	Several marsh creation sites are being evaluated west of Calcasieu Lake. Duplicate of Measures #3 and 124.
74	74a, 74b, 74c	Cameron: Need spillway structures at East Calcasieu Lake (A), Humble Canal (B), North of Deep Lake (C)	Scoping	2, 3, & 4	Yes	
75	75a and 75b	Cameron: Need sediment bypass at Mermentau River and Calcasieu Ship Channel	Scoping	N/A	No	Both measures were considered. CPRA performed a recon-level evaluation of a proposed CIAP project similar to 75b. The findings were: 1. Sand availability from the borrow source at the east side of the jetty is of limited volume; 2. The shoreline to the east of the jetty, which includes 4,000 feet of shoreline adjacent to the jetty, is currently subject to erosion. It is not common practice to use sand from eroding shorelines as a borrow source for beach nourishment at other places; and 3. A breach at the

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						north end of the east jetty could occur if the width of the beach on the Gulf side is reduced due to excavation of sand, posing a problem for jetty stability and general shoreline erosion. Based on these findings, both 75a and 75b were removed from consideration in this study.
76	12, 16b, 26	Cameron: Need shoreline protection at Grand, Sweet, and Willow Lakes, and Freshwater Bayou	Scoping	5	Yes	Duplicate of Measures #12, 16, and 26. Only Freshwater Bayou portion of this measure was carried forward.
77	N/A	Cameron: Put a barrier along Calcasieu Lake	Scoping	N/A	No	Barriers already exist along the shorelines of much of Calcasieu Lake.
78	N/A	Cameron: Streamline the permitting process as related to existing structures/terraces	Scoping	N/A	No	Does not address planning objectives.
79	N/A	Cameron: There is marsh loss at Gum Cove	Scoping	N/A	No	This is a problem statement rather than a measure. Does not address any planning objectives. Gum Cove is located in a relatively stable subunit that shows a recent (1984 to 2010) land gain trend of 6 acres/year. Local marsh benefits from the hydrologic restoration project CS-27.
80	N/A	Cameron: There is water retention/drainage problem in Creole, sedimentation in Creole Canal	Scoping	N/A	No	This is a problem statement rather than a measure. Will be evaluated through H&H modeling.
81	N/A	Cameron: Trees have been lost at Rutherford Beach because of erosion	Scoping	N/A	No	This is a problem statement rather than a measure. Chenier reforestation will be evaluated under Measure #510.
82	N/A	Cameron: There is rapid land loss at Grand Chenier/Johnson Bayou	Scoping	N/A	No	This is a problem statement rather than a measure. This is partially addressed by Measure #47.
83	N/A	Lake Charles: Use dredge material from Cameron Loop for levee repair	Scoping	N/A	No	Does not address any planning objective. Dredge material is more suitable for marsh restoration than levee repair.
84	TBD	Lake Charles: Make every effort to maintain Highway 82	Scoping	1	No	Duplicate of Measure #44.
85	N/A	Lake Charles: Streamline the regulatory process for existing structures	Scoping	N/A	No	Does not address any planning objectives.
86	N/A	Lake Charles: Plan to protect and restore the areas north of I-10	Scoping	N/A	No	Stated as an objective not a measure. Hurricane risk reduction Measures #149, 411, and 412 would address this objective.
87	N/A	Lake Charles: Create an artificial barrier off the coast	Scoping	N/A	No	Not specific enough to determine which planning objectives would be met.
88	N/A	Lake Charles: Restore wetlands	Scoping	N/A	No	Restoring wetlands is an opportunity that will be addressed by the study but it does not meet the definition of a measure.

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89	N/A	Lake Charles: Limit the depth of the ship channel	Scoping	N/A	No	The Calcasieu Ship Channel is an authorized navigation channel with authorized dimensions. This measure would violate the constraint to avoid actions that negatively affect the ability of authorized navigation projects to continue to fulfill their purpose. Any changes to those dimensions would have to be addressed through the navigation authority.
90	N/A	Lake Charles: Use sheet pile in the Intracoastal and Calcasieu ship channel to prevent erosion	Scoping	N/A	No	Use of sheet pile is not relevant to meeting objectives. Sheet pile will be considered for use on all shoreline protection projects.
91	N/A	Lake Charles: Drainage concerns caused by levees; pumps may not be adequate.	Scoping	N/A	No	Does not meet the definition of a measure. Effects of any proposed structural measures will be evaluated.
92	N/A	Lake Charles: Repair levee east of Calcasieu Lake	Scoping	N/A	No	The Cameron/Creole levee has been repaired and is part of the future without project condition.
93	N/A	Lake Charles: Drainage boards by watershed	Scoping	N/A	No	Does not address any planning objectives.
94	N/A	Lake Charles: Need gate at Contraband Bayou and ship channel	Scoping	N/A	No	Does not address any planning objectives as a stand-alone measure. Will be considered part of Hurricane Storm Damage Risk Reduction Measure #411.
95	N/A	Abbeville: Issues goes upriver to where Atchafalaya splits; sediment delivery needs to be measured	Scoping	N/A	No	Does not meet the definition of a measure. Upriver changes may be better investigated through the proposed LCA Upper Atchafalaya Basin Study.
96	N/A	Abbeville: Worried that gates will hold water in just as it holds water out; need way for water to be let out	Scoping	N/A	No	Does not meet the definition of a measure. Effects of any proposed structural measures will be evaluated.
97	N/A	Abbeville: Implement canal speed regulations for boats	Scoping	N/A	No	Although implementing boating speed limits is consistent with study objectives, the costs/benefits would be uncertain and unquantifiable. There is difficultly in enforcing these types of regulations.
98	507, 508	Abbeville: Consider artificial reef creation; Navy ships could be used as reefs by sinking them; old oil platforms or sheet pile could be used	Scoping	5	Yes	Reef-like structures will be investigated under Measures #507 and 508.
99	99a	Barrier Shoreline Restoration: Freshwater Bayou to South Point/Marsh Island (Western section)	Scoping/ LACPR PU3b 1-10	5	Yes	Available data and information suggest shoreline recession rates are relatively low (although localized hotspots do exist) due to longshore sediment transport from Atchafalaya River. Measure #99a refined to provide protection to Cheniere Au Tigre, which is a unique natural feature that provides some degree of storm surge protection to inland areas/communities.
	N/A	Barrier Shoreline Restoration: Freshwater	Scoping/	N/A	No	This portion of the measure was screened out because it is

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Initial ID	Feature No.	Name/Description/Location	Source	Objective No.	Incorporated into the initial array of features?	
		Bayou to South Point/Marsh Island (Marsh Island section)	LACPR PU3b 1-10			outside the authorized study area.
100	47a, 47c	Abbeville: Need marsh creation at Grand Chenier	Scoping	7	Yes	Duplicate of Measure #47.
101	N/A	Abbeville: Preserve fresh water marsh	Scoping	N/A	No	Preservation of freshwater marsh addressed through ecosystem restoration objectives.
102	507, 508	Abbeville: Restore reefs	Scoping	5	Yes	Salinities may be too low to sustain oyster reefs in the Acadiana Bays; however, reef-like structures will be investigated under Measures #507 and 508.
103	N/A	Abbeville: Need flood protection	Scoping	N/A	No	Flood damage reduction is a planning objective not a measure.
104	N/A	Abbeville: Use rocks to rebuild levees	Scoping	N/A	No	Construction method rather than a specific measure. The most cost efficient method of levee construction will be evaluated.
105	N/A	Abbeville: Levee height needs to be addressed	Scoping	N/A	No	Not a measure. Detailed hydrodynamic modeling and analysis will be used to determine levee heights.
106	N/A	Abbeville: Put material against levee wall to stop erosion due to barge traffic	Scoping	N/A	No	Construction method rather than a specific measure.
107	N/A	Abbeville: Address flooding from the Gulf	Scoping	N/A	No	Flood damage reduction is a planning objective not a measure.
108	N/A	Implement State Right of Access for Geotechnical, Environmental, Coastal planning efforts similar to Surveying	Scoping	N/A	No	Does not meet the definition of a measure.
109	N/A	Salinity control Structure at Mermentau River Navigation Channel /Salinity Control at Hog Bayou	Coast 2050	N/A	No	Does not address any planning objectives because Hog Bayou is silting in and is being short-circuited by Beach Prong.
110	16b	Freshwater Bayou Bank Protection, Belle Isle to Lock	LACPR 3b 1-8	5	Yes	Duplicate of Measure #16b.
111	N/A	Marsh Island Shoreline Protection	LACPR 3b 1-10	N/A	No	This measure is outside the authorized study area.
112	99a	Gulfshore Protection from Freshwater Bayou to Southwest Pass	LACPR 3b 1-11	5	Yes	Duplicate of Measure #99.
113	113b2	Stabilize Shoreline of Vermilion, East & West Cote Blanche Bays (via Rock Dike)	LACPR 3b 1-12	5	Yes	Shoreline reaches outside the authorized study area were screened out. USGS analyses of the remaining shoreline reaches showed relatively low recession rates along much of Vermilion Bay. Measure #113b2 along Southwest Point was carried forward due to concerns that the loss of the Point could result in increased marine influences (i.e., saltwater intrusion, tidal action) in Vermilion Bay.
114	114a	LA Highway 333/82 Hurricane Protection.	Vermilion Parish	1	Yes	In the ADCIRC model, highway will be raised in low spots only;

Table C-1, Initial NED and NER Features Compiled and Screened

Initial ID	Feature No.	Name/Description/Location	Source	Objective No.	Incorporated into the initial array of features?	
						highway assumed to be maintained by LA DOTD.
	114b	LA Highway 330 Hurricane Protection. Armor south side of east side of LA 330.	Vermilion Parish	1	Yes	In the ADCIRC model, highway will be raised in low spots only; highway assumed to be maintained by LA DOTD.
115	N/A	Sabine Basin Watershed Management (Maximize Freshwater Inflow from Sabine River)	SMP 4-19	N/A	No	Doesn't address any planning objectives. CRMS data indicate the area is relatively healthy and not in need of salinity/hydrologic control.
116	N/A	Salinity Control Structure at Oyster Bayou	LCA PBMO/ LACPR 5-1	N/A	No	This project has already been constructed as part of local Ducks Unlimited/NAWCA restoration efforts.
117	N/A	Salinity Control Structure at Long Point Bayou	LCA PBMO/ LACPR 5-2	N/A	No	Doesn't address any planning objectives. CRMS data indicate the area is relatively healthy and not in need of salinity/hydrologic control.
118	17a	Salinity Control Structure at Alkali Ditch	LCA PBMO/ LACPR 5-4	2	Yes	Duplicate of Measure #17a
119	602	Modify existing Cameron-Creole Watershed Control Structure	LCA PBMO/ LACPR 5-5	2, 3, & 4	Yes	Change in structure operations will be considered under Measure #602.
120	N/A	East Sabine Hydrologic Restoration	LCA PBMO/ LACPR 5-8	N/A	No	Does not meet the definition of a measure.
121	21c	Freshwater Introduction at Pecan Island	LCA PBMO/ LACPR 5-9	2 & 4	Yes	Duplicate of Measure #21c.
122	21b	Freshwater Introduction at South Grand Chenier	LCA PBMO/ LACPR 5-13	2 & 4	Yes	Duplicate of Measure #21b.
123	N/A	Black Bayou Bypass Culverts	LCA PBMO/ LACPR 5-14	N/A	No	Addressed as part of the CWPPRA CS-29 project.
124	124a-d	Marsh Creation at Mud Lake	LACPR PU4: 1-1	7	Yes	The planning team removed the central portion of Measure #124 because it is located within the existing CWPPRA CS-20 project area.
125	47a, 47c	Marsh Creation at South Grand Chenier	LACPR PU4 1-2	7	Yes	Duplicate of Measure #47.
126	47f, 47h	Marsh Creation at South Pecan Island	LACPR PU4 1-3	7	Yes	Duplicate of Measure #47.
127	127c	Marsh Creation at East Pecan Island (Eastern portion)	LACPR PU4 1-4	7	Yes	The planning team reduced acreage of this measure to focus on an area of recent land loss near the west bank of the Freshwater Bayou Canal.
128	3a1	Marsh Creation at NW Calcasieu	LACPR 2-6	7	Yes	Duplicate of Measure #3.
129	N/A	Marsh Creation at No-Name Bayou	LACPR PU4 1-5	N/A	No	Measure screened out because it overlaps with a proposed Calcasieu Ship Channel DMMP site.

Table C-1, Initial NED and NER Features Compiled and Screened

Initial ID	Feature No.	Name/Description/Location	Source	Objective No.	Incorporated into the initial array of features?	
130	3c	Marsh Creation at East Calcasieu Lake	LACPR 2-7	7	Yes	Duplicate of Measure #3.
131	N/A	Marsh Creation at Black Bayou	LACPR PU4 1-8	N/A	No	Measure screened out because it did not meet screening criteria; i.e., it would not reinforce critical landscape features, it is far from a preferred borrow source, and it is in an area proposed for Sabine-Neches Waterway mitigation.
132	N/A	Marsh Creation at Gum Cove	LACPR PU4 1-9	N/A	No	Measure screened out because it did not meet screening criteria; i.e., it is far from a preferred borrow source, and it is in an area proposed for Sabine-Neches Waterway mitigation.
133	N/A	Marsh Creation at Cameron Meadows	LACPR PU4 1-10	N/A	No	Measure screened out because it did not meet screening criteria; i.e., it would not reinforce critical landscape features, and it is in an area of geologic instability.
134	N/A	Marsh Creation at Central Canal	LACPR PU4 1-11	N/A	No	Measure screened out because it did not meet screening criteria; i.e., it would not reinforce critical landscape features, it is far from a preferred borrow source, and it is in an area proposed for Sabine-Neches Waterway mitigation.
135	135a	Marsh Creation at Sweet Lake	LACPR PU4 1-12	7	Yes	The planning team repositioned this measure to avoid deep water areas with poor geotechnical conditions.
136	N/A	Brady Canal Area Marsh Creation	LACPR PU3b 1-15	N/A	No	This measure is outside the authorized study area.
137	3a1, 3c	Marsh Creation & Terracing northwest of Calcasieu Lake and East Calcasieu Marsh Creation	LACPR PU4 1-6 and 1-7	7	Yes	Duplicate of Measure #3.
138	N/A	Raise existing oilfield canals spoil bank alignments for storm surge	Vermilion Parish	N/A	No	Vermilion Parish would like to use dredge material from oilfield canal dredging to fortify the spoil banks rather than use the material for marsh nourishment. The purpose would be to allow for the establishment of trees and other vegetation that are more effective for multiple lines of defense, i.e., breaking of wind and waves, etc. This would violate the study constraint of avoiding actions that deprive one area of limited sediment resources to benefit projects in another area. Any such operational change is a permitting and policy issue that needs to be vetted through LDNR and USACE wetland permitting.
139	16b, 26	Fortify spoil banks of GIWW and Freshwater Bayou	LACPR PU 3b 3-15/	5	Yes	Duplicate of Measures #16b and 26. Only Freshwater Bayou portion of this measure was carried forward.

Table C-1, Initial NED and NER Features Compiled and Screened

Initial ID	Feature No.	Name/Description/Location	Source	Objective No.	Incorporated into the initial array of features?	
			Vermilion Parish			
140	511	Flood Control Structure at Boston Canal	Vermilion Parish	1	Yes	Duplicate of Measure #511.
141	141	Four Mile Canal Structure	Vermilion Parish	1	Yes	
142	142	Hebert Canal Watershed/storm protection	Vermilion Parish	1	Yes	
143	143	Flood Control Structure at Oaks Canal	Vermilion Parish	1	Yes	CBDG project.
144	144a-c	Protection Levee on the marsh/ upland interface	Vermilion Parish	1	Yes	Alignment needs to be smoothed. Will be modeled in ADCIRC for further screening evaluations.
145	144a-c	Bayou Tigre Watershed Flood Protection	Vermilion Parish	1	Yes	Will be considered under Measure #144.
146	146	Gueydan 100-year protection ring levee	LACPR	1	Yes	Will be evaluated with ADCIRC modeling for further screening.
147	149, 601	C-RL-100-1 (100-yr risk reduction through ring levees and nonstructural)	LACPR	1	Yes	Duplicate of Measures #149 and 601.
148	149, 601	C-RL-400-1	LACPR	1	Yes	Duplicate of Measures #149 and 601. Combined 100-yr, 400-yr, and 1000-yr LACPR alternatives into one measure since they are on the same footprint. Level of risk reduction to be determined.
149	149	Lake Charles Ring Levee	LACPR	1	Yes	LACPR Measures CL-RL-100-1, CL-RL-400-1, and C-RL-1000-1 all on same footprint. Level of risk reduction to be determined. Measure #149 is an alternative to Measures 411/412.
150	GIWW	Continuous levee along the GIWW from Vermilion Bay to west of Vinton	LACPR Atlas PU4-G	1	Yes	Duplicate of Measure #34. Study authority requires assessing the "feasibility of constructing an armored 12-foot levee along the Gulf Intracoastal Waterway."
151	149, 411, 412, 146, 409, 114, 144	Large ring levees around Vinton/Lake Charles and Gueydan/Kaplan/Abbeville	LACPR Atlas PU4-RL-2	1	Yes	Ring levees will be modeling with ADCIRC for further screening.
152	149, 411, 412, 146, 409, 114, 144	Small ring levees around Vinton, Lake Charles, Gueydan, and Kaplan	LACPR Atlas PU4-RL	1	Yes	Ring levees will be modeling with ADCIRC for further screening.
153	N/A	Continuous levee following Highway 82	LACPR Atlas PU4-H	N/A	No	Duplicate of Measure #33.
154	N/A	Levees along the 10-foot contour	LACPR Atlas PU4-C	N/A	No	Duplicate of Measure #35.
155	GIWW, 149, 411, 412	100-year levee along the GIWW and 500-year ring levee around Vinton/Lake Charles	LACPR Atlas PU4-State	1	Yes	Duplicate of Measures #149, 411, and 412.
156	N/A	Continuous levee along the GIWW from	LACPR Atlas	N/A	No	This measure is outside the authorized study area.

Table C-1, Initial NED and NER Features Compiled and Screened						
Initial ID	**Feature No.**	**Name/Description/Location**	**Source**	**Objective No.**	**Incorporated into the initial array of features?**	
		Morgan City to Vermilion Bay	PU3b-G-1			
157	N/A	Continuous levee along the GIWW from Morgan City to Abbeville	LACPR Atlas PU3b-G-2	N/A	No	This measure is outside the authorized study area.
158	N/A	Continuous levee from Franklin to Abbeville inland of the GIWW	LACPR Atlas PU3b-FA	N/A	No	This measure is outside the authorized study area.
159	N/A	Continuous levee from Franklin to Abbeville from preliminary draft of State Master Plan	LACPR Atlas PU3b-FA-State	N/A	No	This measure is outside the authorized study area.
160	601	Permanent Evacuation	LACPR Atlas	1	Yes	Will be considered under Measure #601.
161	601	Relocation of Residential Assets along Hwy LA 82	LACPR Atlas	1	Yes	Duplicate of Measure #38. Will be considered under Measure #601.
162	601	Buyout	LACPR Atlas	1	Yes	Duplicate of Measure #38. Will be considered under Measure #601.
163	601	Wet/Dry flood Proofing of Structures	LACPR Atlas	1	Yes	Duplicate of Measure #41. Will be considered under Measure #601.
164	601	Raising in Place	LACPR Atlas	1	Yes	Duplicate of Measure #59. Will be considered under Measure #601.
165	601	Permanent Evacuation	LACPR Atlas	1	Yes	Duplicate of Measure #38. Will be considered under Measure #601.
166	601	Relocation of Residential Assets along Hwy LA 82	LACPR Atlas	1	Yes	Duplicate of Measure #38. Will be considered under Measure #601.
167	601	Buyout	LACPR Atlas	1	Yes	Duplicate of Measure #38. Will be considered under Measure #601.
168	601	Wet/Dry flood Proofing of Structures	LACPR Atlas	1	Yes	Duplicate of Measure #41. Will be considered under Measure #601.
169	601	Raising in Place	LACPR Atlas	1	Yes	Duplicate of Measure #59. Will be considered under Measure #601.
170	N/A	Cameron - Estuarine Species Management	Cameron Parish	N/A	No	Does not meet the definition of a measure.
171	N/A	Cameron - Beneficial Use of Dredged Material	Cameron Parish	N/A	No	Does not meet the definition of a measure. Marsh creation sites have been identified in Cameron Parish that could beneficially use dredged material.
172	N/A	Cameron - Water Level Management	Cameron Parish	N/A	No	Does not meet the definition of a measure. The Chenier Plain Hydrodynamic model will be used to evaluate methods of water level management.
173	N/A	Cameron - Sediment Management	Cameron Parish	N/A	No	Does not meet the definition of a measure. Sediment management will be evaluated as part of this study.
174	N/A	Cameron - Salinity Control Structures	Cameron Parish	N/A	No	Does not meet the definition of a measure (no location

Table C-1, Initial NED and NER Features Compiled and Screened

Initial ID	Feature No.	Name/Description/Location	Source	Objective No.	Incorporated into the initial array of features?	
						specified).The Chenier Plain Hydrodynamic model will be used to evaluate placement of potential Salinity Control Structures. See Measures #48, 407, 17a, 17b, 17c, 7, 74a, 74b, 74c, 21a, 21b, 21c, 13, and 603.
175	N/A	Cameron - Locks replacement and management	Cameron Parish	N/A	No	Does not address any planning objectives. The Chenier Plain Hydrodynamic model will be used to evaluate the need to replace or manage locks in Cameron Parish. Will be considered under Measure #602.
176	5a, 6b, 49b1	Cameron - Shoreline stabilization	Cameron Parish	7	Yes	Shoreline stabilization measures are being considered in Cameron Parish. See Measures #5a, 6b, and 49.
177	N/A	Cameron - Flood relief structure	Cameron Parish	N/A	No	Does not meet the definition of a measure. H&H modeling will determine placement of flood control structures.
178	N/A	NRCS Cooperative River Basin studies	NRCS	N/A	No	Does not meet objectives. Reports are outdated (over 15 years old) and the measures are too small and specific to individual landowners to comprehensively address study area problems. Better addressed by NRCS programs.
300	114, 144, 141, 142, 143, 511	Abbeville & Vicinity Hurricane Protection (via Earthen Levee/Major Structure)	SMP 3b-1	1	Yes	Will establish benefit-cost ratio using initial ADCIRC results.
301	16b	Bankline Stabilization of Freshwater Bayou from Belle Isle Bayou to Freshwater Bayou Canal Lock (via Rock Dike)	SMP 3b-7	5	Yes	Duplicate of Measure #16b.
302	N/A	Increase Sediment Transport Down Wax Lake Outlet (via Channel Construction)	SMP 3b-8	N/A	No	This measure is outside the authorized study area.
303	N/A	Southwest Pass Shoreline Stabilization (via Rock Dike)	SMP 3b-9a	N/A	No	Measure was investigated. USGS analyses showed relatively low shoreline recession rates (<2 feet per year). Therefore, this measure was excluded from further analysis because it doesn't address an area of critical need.
304	304a, 304b	Southwest Pass Sills	SMP 3b-9	5	Yes	Measures #304a and 304b are dependent on each other.
305	26	Bankline Protection for Gulf Intracoastal Waterway (GIWW) (via Rock Dike)	SMP 3b-11	N/A	No	Duplicate of Measure #26.
306	306a, 306b	Rainey Marsh Restoration	SMP 3b-12	7	Yes	There has been little recent land loss in the original location of this measure. Therefore, the measure was repositioned to the area just east of Freshwater Bayou Canal, where there is a greater need for marsh restoration to reinforce the bankline.
307	N/A	Marsh Restoration Using Dredged Material at	SMP 3b-14	N/A	No	This measure is outside the authorized study area.

Table C-1, Initial NED and NER Features Compiled and Screened

Initial ID	Feature No.	Name/Description/Location	Source	Objective No.	Incorporated into the initial array of features?	
		Weeks Bay				
308	26, 16b	Fortify Spoil Banks of GIWW & Freshwater Bayou	SMP 3b-19	5	Yes	Duplicate of Measures #16b and 26. Only Freshwater Bayou portion of this measure was carried forward.
400	N/A	South Marsh Island (Restore to ~1978 marsh extent with marsh creation (500 acres)	MLODS	N/A	No	This measure is outside the authorized study area.
401	N/A	Outer Atchafalaya Bay (Restore structural oyster reefs at appropriate isohaline conditions)	MLODS/ SMP 3b-6	N/A	No	This measure is outside the authorized study area.
402	N/A	Wax Lake Outlet (Maintain status quo of active delta)	MLODS/ SMP 3b-8	N/A	No	This measure is outside the authorized study area.
403	N/A	GIWW - Hwy 317 to Hwy 82 (Outfall management to convey freshwater east of Hwy 82)	MLODS/ SMP 3b-13	N/A	No	Duplicate of Measure #24.
404	N/A	Sabine R. to Sabine National WR	MLODS/Draft SMP PU4-16	N/A	No	Duplicate of Measure #1.
405	N/A	GIWW (Outfall management to convey freshwater east of Hwy 82)	MLODS/Draft SMP PU4-17	N/A	No	Duplicate of Measure #24.
406	N/A	Red River/Bayou Beouf (Diversion to convey freshwater through the upper Mermentau Basin and into the lower basin)	MLODS	N/A	No	Does not address any planning objectives. Better addressed through the proposed LCA Upper Atchafalaya Basin Study.
407	407	Structure on GIWW at Gum Cove Ridge	MLODS	2	Yes	Purpose is to restore the function of the ridge that hydrologically separated the Sabine and Calcasieu basins.
408	21b, 21c	South of White & Grand Lakes (Flap-gate culverts)	MLODS	2, 3, & 4	Yes	Duplicate of Measure # 21.
409	409	Kaplan 100 year ring levee	MLODS/ LACPR	1	Yes	Will be evaluated with ADCIRC modeling for further screening. Expected to be screened out based on damages vs. levee costs.
410	146	Gueydan 100 year ring levee protection	MLODS/ LACPR	1	Yes	Duplicate of Measure #146.
411	411	Greater Lake Charles region: east side of Calcasieu (New levee alignment 500 year protection provided by the flood protection system)	MLODS/SMP	1	Yes	1% annual depth of flooding may be maximum feasible level of protection. Will be modeled in ADCIRC for further screening evaluation. Measure #94 from hydrologic/ salinity control measures is considered part of this measure. Measures #411 (east) and 412 (west) are meant to be considered as a system for providing risk reduction for the Lake Charles area for storm surge. Measures #411/412 are an alternative to Measure #149.
412	412	Greater Lake Charles region: west side of	MLODS/SMP	1	Yes	See comment for Measure #411 above.

Table C-1, Initial NED and NER Features Compiled and Screened

Initial ID	Feature No.	Name/Description/Location	Source	Objective No.	Incorporated into the initial array of features?	
		Calcasieu (New levee alignment 500 year protection provided by the flood protection system)				
413	N/A	White Lake-Grand Lake Land Bridge (Restore & maintain landbridge with marsh creation and shoreline protection)	MLODS	N/A	No	Measure screened out because it did not meet screening criteria. Furthermore, the Grand-White Lakes Landbridge Protection (ME-19) CWPPRA project is part of the future without project condition.
414	416	Grand Chenier ridges (Restore ridges and upland forests on prominent ridges)	MLODS/ Preliminary Draft SMP	6	Yes	Duplicate of Measure #416.
415	510a, 510b	Hackberry & Blue Buck Ridges (Restore ridges and upland forests on prominent ridges)	MLODS/ Preliminary Draft SMP	6	Yes	Duplicate of Measure #510.
416	416	Grand Chenier Ridges (Restore ridges and upland forests on prominent ridges)	MLODS/ Preliminary Draft SMP	6	Yes	
500	N/A	Create marsh at Weeks Bay	LACPR PU3b 3-10	N/A	No	Duplicate of #307.
501	306a, 306b	Restore marsh at Marsh Island south shoreline and Rainey Marsh via dedicated dredging	LACPR PU3b 1-17 and 3-8	7	Yes	Marsh Island portion excluded because it is outside the authorized study area. Rainey marsh portion of this measure is a duplicate of Measure #306.
502	N/A	Increase sediment transport from Atchafalaya River down Wax Lake Outlet (via Major Structure)	LACPR PU3b 2-4	N/A	No	Duplicate of #302.
503	N/A	Historic Reef from Point Chevreuil to Marsh Island	Coast 2050	N/A	No	This measure is outside the authorized study area.
504	N/A	Historic Reef from Point Au Fer to Marsh Island		N/A	No	This measure is outside the authorized study area.
505	N/A	Improve hydrology of the old Mermentau River Channel between Mud Lake and Gulf of Mexico. (via Channel Restoration)		N/A	No	Duplicate of Measure # 25.
506	N/A	Restore marsh by filling abandoned canals	Preliminary Draft SMP	N/A	No	Duplicate of Measure #23.
507	507	Feature from Dead Cypress Point (Near Cypremort Point) to Near Bayou Michael (NW Corner of Marsh Island) (to Replace	Planning Team	5	Yes	Purpose of the measure is to reduce wave fetch and thus shoreline erosion along Vermilion Bay. Proof of concept in early phase 2a using three historic storms (Audrey, Rita & Ike) before

Table C-1, Initial NED and NER Features Compiled and Screened

Initial ID	Feature No.	Name/Description/Location	Source	Objective No.	Incorporated into the initial array of features?	
		Historic Reefs)				proceeding further. LDWF doesn't think oysters will thrive in this location, therefore feature described as a submerged sill rather than reef restoration.
508	508	Feature from Marone Point or Point No Point to Lake Point (Marsh Island) (to Replace Historic Reefs)	Planning Team	5	Yes	See comment for #507 above.
509	509a,c,d	Restore/Sustain Chenier ridges and upland forests on prominent ridges in Vermilion Parish	MLODS/ Preliminary Draft SMP	6	Yes	
510	510a,b,d	Chenier Ridges in Cameron Parish (Restore/Sustain ridges and upland forests on prominent ridges	MLODS/ Preliminary Draft SMP	6	Yes	
511	511	Boston Canal Structure	Planning Team	1	Yes	CBDG project.
512	17a	Alkali Ditch	LCA PBMO/ LACPR 5-4	2	Yes	Duplicate of Measure #17a.
513	TBD	Erath/Delcambre and Vicinity (Vermilion Parish)	LACPR	1	Yes	For comparison with Measure #144. Added measure to highlight protection along/near the upland/marsh interface. Base condition modeling results needed to determine risk. LACPR identified two basic demonstration projects in Delcambre. They are relocation/buyout of existing residential and some commercial structures and flood proofing of existing critical facilities such as schools, water treatment facilities, police and fire stations, and city halls, as well as some commercial structures in the downtown areas considered critical to the community such as grocery stores and pharmacies.
600	16b	Freshwater Bayou Rock Armor	Stakeholder	7	Yes	The majority of this is a duplicate of Measure #16b. The one portion that does not overlap with 16b showed relatively low shoreline recession rates (about 3 feet/year).
601	601	Placeholder for nonstructural measures	LACPR	1	Yes	Implementation of nonstructural measures requires a multi-agency approach, involving the Federal Emergency Management Agency (FEMA), the National Oceanic & Atmospheric Association, the National Weather Service, U.S. Department of Transportation, the United States Housing and Urban Development Administration the U.S. Army Corps of Engineers, the Coastal Protection and Restoration Authority, the Governor's Office of Homeland Security and Emergency Preparedness and

Table C-1, Initial NED and NER Features Compiled and Screened

Initial ID	Feature No.	Name/Description/Location	Source	Objective No.	Incorporated into the initial array of features?	
						numerous other Federal, State, and local agencies.
602	602	Operational changes to existing structures	Planning Team	2, 3, & 4	Yes	Measures to be formulated pending results of Chenier Plain Hydrodynamic modeling.
603	603	Control structure at Tom's Bayou	Planning Team	2	Yes	
604	604	Preservation of Sabine Historic Oyster Reefs	Planning Team	1	Yes	Storm surge effects to be modeled in ADCIRC both with and without the oyster reef in the channel.

Following the initial screening features were grouped into NED and NER analysis categories and separated to undertake parallel processes for screening/plan formulation in each category. The features were also separated into Measure groups within each category.

NED PLAN FORMULATION

NED Goal: Provide hurricane and storm damage risk reduction and reduce flooding induced by storm surge.

Problems	Opportunities	Objectives	Measures
Flooding from tidal surge and waves associated with tropical storms	Raise or remove buildings out of the floodplain. Block surge with levees and floodgates.	Objective 1. Reduce the risk of economic losses from flooding caused by hurricanes and storm surges.	Structural (levees, floodgates, floodwalls, pumps) or Non-Structural (raise or buyout property)

The NED analysis category was comprised of two primary measure groups Structural and Non-structural. Following the initial screening forty-six remaining features were identified that would provide hurricane and storm damage risk reduction to the area. Twenty of them were nonstructural in nature. The evaluation of non-structural viability was considered generically across the entire study area as part of the NED array. The team determined that specific application of non-structural methods would be defined in the feasibility design phase subject to the justification of a programmatic non-structural plan.

The remaining 26 features presented in Table C-2 below were structural risk reduction measures and received preliminary individual evaluation in the initial NED array.

Table C-2, Initial Array of NED Structural Risk Reduction Features

No.	ID/ Feature #	Description	Name	Basin	Source
1	1	Armored 12-ft earthen levee along the GIWW		Calcasieu-Sabine, Mermentau	Southwest Coastal Louisiana Reconnaissance Report
2	34	Abbeville to Lake Charles Hurricane Protection		Calcasieu-Sabine, Mermentau	State Master Plan
3	35	New levee alignment along the 10-ft contour (from Abbeville to Texas border)		Calcasieu-Sabine, Mermentau	
4	56	Raising and maintaining Highways 82 and 27 in Cameron Parish		Calcasieu-Sabine	State Master Plan
5	57	Proposed hurricane protection levee for 30-A storm surge at coastline.			
6	65	Cameron: Use old Calcasieu Lock for flood control.			
7	138	Raise existing oilfield canals spoil bank alignments for storm surge			
8	114a	LA Highway 333/82 Hurricane Protection	N/A	Mermentau	Vermilion Parish

9	114b	LA Highway 330 Hurricane Protection	N/A	Mermentau	Vermilion Parish
10	141	Four Mile Canal Structure (V3)	N/A	Mermentau	Vermilion Parish Plan
11	142	Hebert Canal Watershed/storm protection (V5)	N/A	Mermentau	Vermilion Parish Plan
12	143	Flood Control Structure at Oaks Canal (V8)	N/A	Mermentau	Vermilion Parish Plan
13	144a	Extension of Protection Levee on the marsh/upland interface (V6) to GIWW West of Forked Island	Protection Levee on the marsh/ upland interface	Mermentau	Vermilion Parish Plan
14	144b	Protection Levee on the marsh/upland interface (V6)			
15	144c	Extension of Protection Levee on the marsh/upland interface (V6) to Delcambre Canal			
16	146	Gueydan 100 yr ring levee protection PU4_fl_1000_3	Gueydan ring levee	Mermentau	LACPR
17	149a	C-RL-1000-1 Lake Charles Ring Levee/CL-RL-100-1/CL-RL-400-1 (on same footprint)	Lake Charles ring levee	Calcasieu-Sabine	LACPR
18	150	Continuous levee along the GIWW from Vermilion Bay to west of Vinton		Calcasieu-Sabine, Mermentau	
19	155	100-year levee along the GIWW and 500-year ring levee around Vinton/Lake Charles.		Calcasieu-Sabine	
20	156	Continuous levee along the GIWW from Morgan City to Abbeville.		Calcasieu-Sabine, Mermentau, Teche-Vermilion	
21	159	Continuous levee from Franklin to Abbeville.			Draft State Master Plan
22	409	Kaplan 100 yr ring levee	Kaplan ring levee	Mermentau	MLODS/ LACPR
23	411	Greater Lake Charles region (New levee alignment 500 year protection provided by the flood protection system)	Lake Charles ring levee	Calcasieu-Sabine	MLODS/State Master Plan
24	412				
25	511	Boston Canal	N/A	Mermentau	Planning Team
26	513	Delcambre, Erath and vicinity levee alignment		Mermentau	LACPR

Data and Assumptions Applied to NED Plan Evaluation

Stage-Probability Curves Data and Assumptions:

- Blended rainfall flooding from the HEC-RAS model with surge flooding from the ADCIRC model. Therefore, damages could be from surge and/or rainfall flooding.
- Surge elevations are still water only (no waves).

- No surge results were available for the 1-yr to 25-yr frequencies because ADCIRC typically does not compute below the 50-yr threshold.
- To indicate whether the subunits is surge and/or rainfall dominated, hydraulics has designated subunits by "zone" as follows:
    - North-0 results are 100% HEC-RAS.
    - North-1 is HEC-RAS below the 100-year, the greater of HEC-RAS or ADCIRC at the 100-year, and ADCIRC above the 100-year.
    - North-2 is adjusted HEC-RAS at 100-year and below, with ADCIRC above the 100-year. From this point the magnitude of the adjustment is the smallest. Adjustments were ADDED to HEC-RAS values to simulate ADCIRC runs that are not calculated. The difference between 100-year events is the maximum adjustment and linearly decreases to zero at the 1-year event.
    - South-0 to South-2 are calculated the same as North-2, but the magnitude of adjustment keeps getting bigger with each successive group.

Cost Data and Assumptions:

- "Low" scenario cost calculated using $21M/mile armored; $19M/mile un-armored (grass only).
    - The unarmored cost is based on indexing the LACPR estimates to current levels assuming the existing ground elevation is +5 for a 12' levee elevation of +17 with contingency, the levee $/mile would be about $15.5M for the levee only. It would be around $18.6M if you include E&D and S&A. Rounded to $19M/mile.
    - Added $2 million/mile for additional armoring to the study authority measure.
    - Similar to the Westshore Lake Pontchartrain study levee costs.
- "High" cost calculated using $32M/mile armored; $29M/mile un-armored (grass only).
    - High costs based on 50% increase over Low costs rounded up to nearest million.
    - High costs are still lower than for some other studies (e.g. Morganza to the Gulf) but those costs were not used because of different soil conditions/geographic location (e.g. Morganza levees were in wetland/open water areas close to the Gulf vs. Southwest Coastal levees along the banks of the GIWW).

Damage/Benefit Data and Assumptions:

- Benefits assume a 100-yr levee in place.
- With-project damages for the 1-yr through 10-yr event and the 500-yr event (see highlighted cells in table 1) are assumed to be the same as the without-project values (no benefits for those events) for the following reasons:
    - 1-yr through 10-yr are rainfall events and those damages would remain even with the levee/pumps in place (assuming pumps only to alleviate induced flooding caused by levee in place, NOT to eliminate rainfall flooding that existed prior to the levee project).
    - The 500-yr event is assumed to overtop the 100-yr levee.
- With-project damages for the 25-yr to 200-yr event are assumed to be reduced to zero. The 200-yr event was included because Morganza 100-yr levee was shown to reduce damages up to the 200-yr event.

Screening of the NED Initial Array

Analysis of the initial array was conducted as described in Table C-3. Data generated by the structural inventory was assigned to the hydrologic units that would be protected by each structural plan. The annual damages were modeled, resulting in annual damages. Aggregated subunit damages avoided were then considered to be project benefits and used to estimate the project cost that could be supported for each plan. Costs were estimated based on previous project costs per distance measurement, with estimated pumping costs included. Benefits and costs were compared to determine the potential for benefit cost ratios that exceeded 1, and would therefore be justified.

Early modeling output that overlaid Expected Annual Damages (EAD) for structure inventory and sub unit damages was used in combination with screening results to form the intermediate array.

Table C-3, Summary of Initial Ring Levee Screening Steps and Results

What	Why	How (Methods/Assumptions)	Results
Adjusted structure inventory…	…to address repetitive damages and rebuild assumptions.	Similar to Morganza method, raised structures in the database that are below the existing (2012) 10-yr floodplain elevation to an elevation above the 100-yr floodplain.	Of the approximately 52,000 structures in the inventory, 3,881 were elevated above the 2012 100-yr floodplain.
Modeled annual damages…	…to determine without-project damages for existing (2012) conditions.	Ran HEC-FDA model by subunit (reach).	Total of $113M annual damages for the entire study area (90 subunits).
Screened subunits....	…to ensure only relevant subunits/data used for screening structural measures and to reduce unnecessary calculations.	Ignored subunits (1) with zero structures/damages (2) south of proposed levees or (3) north of proposed levees but dominated by rainfall flooding.	Of the 90 original subunits, only 40 used for screening because: 22 are wetland areas containing no structures; 22 are south of the GIWW and; 6 were north of proposed levees but dominated by rainfall damages.
Calculated existing annual benefits…	…for subunits behind levees to determine the existing benefits of proposed levee.	Used an Excel spreadsheet, data from Step 2, and a set of simplifying assumptions.	Varies by subunit. In $1000s in the Gueydan and Kaplan areas, almost $9M in an Abbeville subunit, and over $25M in one of the Lake Charles subunits.
Aggregated subunit data…	…to estimate total annual benefits of each proposed levee measure.	Using maps and Excel spreadsheets.	Varies by ring levee. From thousands (Gueydan & Kaplan) to $35M for Lake Charles levees to over $87M (north of GIWW). See table C-2.
Adjusted annual benefits…	…to account for higher damages in the future due to RSLR and estimate equivalent annual benefits over the period of analysis.	Increased annual benefits by 50% based on trends from Morganza to the Gulf project.	From thousands (Gueydan & Kaplan) to $52M for Lake Charles levees to over $131M (north of GIWW). See table C-2.
Estimated total benefits…	…to determine the order of magnitude of project that could be justified.	Multiplied annual benefits by 20, which is approximately 1 over the interest and amortization factor based on the current interest rate and a 50-yr period of analysis.	From <$1M (Kaplan) to $1B (Lake Charles) to $2.6B (GIWW). See table C-2.
Estimated levee costs…	…for use in preliminary benefit-cost ratio calculations.	Estimated levee costs for low and high cost scenarios. See cost estimate assumptions.	From over $100M for a small ring levee to $2.6 to $3.9 Billion for the armored GIWW levee. See table C-2.
Estimated pumping costs…	…to account for costs of pumps to reduce interior induced flooding causes by levees.	Levee measures will likely require pumping to remove induced rainfall flooding. Pumping costs based on LACPR data.	From several $1M for the smallest ring levees to several $100M for the largest ring levees to over $800M for the GIWW alignment. See table C-2.
Summed levee and pumping costs…	…to get total costs for comparison to total benefits.	Estimated total costs for low and high cost scenarios.	From over $100M for a small ring levee to $3.4 to $4.7 Billion for the armored GIWW levee. See table C-2.
Compare	…to determine which	Excel spreadsheet. If both Low &	**Screened out** the armored 12-ft

What	Why	How (Methods/Assumptions)	Results
benefits to costs…	alternatives to include in the final array.	High C > B, screen the measure out. If B > than Low C, carry measure forward (even if B < High C). If the High C > B > Low C, consider reformulating the measure before running ADCIRC to achieve B > C.	levee along the GIWW. Removed Gueydan and Kaplan from the comprehensive ring levee plan. See table C-2.

- B = Benefits; C = Costs; BCR = Benefit-Cost Ratio

Intermediate Array of NED Alternatives: After combining overlapping features; screening out features with large negative environmental impacts; and identifying ineffective/incomplete features such as highway raisings and lock and flood control structures, 13 features and sub-feature variations were carried forward.

The intermediate array of alternatives for evaluation was as follows:

- Armored 12-ft Levee along the GIWW (Recon Alt S-1) – Carried forward from initial array for evaluation.
- Gueydan ring levee (Feature 146) - Carried forward from initial array for evaluation.
- Kaplan ring levee (Feature 409) - Carried forward from initial array for evaluation.
- Lake Charles ring levees variations - Incremental variations on the Lake Charles ring levee carried forward from initial array for evaluation were evaluated including:
  - Lake Charles ring levee (Feature 149) - southern (east and west)
  - Lake Charles ring levee (Feature 149) - southern/eastern ring only
  - Lake Charles ring levee (Feature 149) - southern/western ring only
  - Lake Charles ring levee (Feature 411/412) - northern (east and west)
  - Lake Charles ring levee (Feature 411/412) - northern/east ring only
  - Lake Charles ring levee (Feature 411/412) - northern/west ring only
- Abbeville ring levee variations – Alternative variations on the Abbeville ring levee carried forward from initial array for evaluation were evaluated including:
  - Abbeville Marsh/Upland Interface (Feature 144b) – Adopted by the Vermilion Parish Policy Jury in their official Hurricane Protection/Restoration Plan in 2009. The Plan addresses features that would reduce storm surge by creating a multiple lines of defense. One of those features is a "Protection Levee on the Marsh/Upland Interface." The area of the marsh/upland interface, south of Louisiana Highway 330 follows the alignment of existing agricultural levees. The plan proposes to raise the height of those agricultural levees.
  - Abbeville ring levee along LA Hwy 330 (Feature 114b)
  - Abbeville ring levee along GIWW – carried forward from Recon Study.
  - Abbeville ring levee (shortened variation of feature carried forward from initial array for evaluation) – Excludes Erath and Delcambre

The evaluation of the intermediate array, presented in Table C-4, identified two plans on the east side of Lake Charles and one plan in the vicinity of Abbeville as viable options for further consideration. In considering other social and economic factors the PDT determined that it would be appropriate to retain plans that addressed the west side of Lake Charles for the final evaluation. Additionally the team opted to retain only the favorable plan that optimized net benefits for East Lake Charles. The evaluation also revealed, in the consideration of a plan focused specifically on community of Abbeville as compared to a larger plan, that a majority of the benefits seemed to be associated with the communities of Delcambre and Erath. As a result, the team also decided to iteratively restore an plan based on feature number 513, Delcambre, Erath and vicinity levee alignment, and retain all three plans for final evaluation.

Table C-4. Evaluation Data for Structural Plans.

Name (feature ID)	Levee Length (miles)	Existing Condition Adjusted EAD	Existing Condition Benefits based on Adjusted EAD	Future RSLR Benefits/ Existing Damages increased by 50%	Best Estimate Benefits x 20	"Low Cost Scenario" Levee + Pumps	"High Cost Scenario" Levee + Pumps	Are best estimate benefits x 20 greater than "Low" costs?	Are best estimate benefits x 20 greater than "High" costs?
1-Armored 12-ft Levee along the GIWW	122	$87M	<$87M	$131M	$2.6B	$3.4B	$4.7B	No	No
149a-Lake Charles RL - southern (east and west)	45	$52M	$35M	$52M	$1.0B	$1.3B	$1.8B	No	No
149a-Lake Charles RL - southern/eastern ring only	22.5	$42M	$31M	$46M	$929M	$576M	$801M	Yes	Yes
149a-Lake Charles RL - southern/western ring only	22.5	$10M	$4	$6M	$119M	$725M	$950M	No	No
411/412-Lake Charles RL - northern (east and west)	45	$41M	$29M	$43M	$866M	$1.2B	$1.7B	No	No
411/412-Lake Charles RL - northern/east ring only	22.5	$33M	$26M	$38M	$767M	$509M	$734M	Yes	Yes

Name (feature ID)	Levee Length (miles)	Existing Condition Adjusted EAD	Existing Condition Benefits based on Adjusted EAD	Future RSLR Benefits/ Existing Damages increased by 50%	Best Estimate Benefits x 20	"Low Cost Scenario" Levee + Pumps	"High Cost Scenario" Levee + Pumps	Are best estimate benefits x 20 greater than "Low" costs?	Are best estimate benefits x 20 greater than "High" costs?
411/412-Lake Charles RL - northern/west ring only	22.5	$8M	$3M	$5M	$99M	$706M	$931M	No	No
144b-Abbeville Marsh/Upland Interface	33	$20M	$16M	$24M	$484M	$990M	$1.3B	No	No
Abbeville RL along GIWW (from Recon)	30	$23M	$18M	$27M	$548M	$933M	$1.2B	No	No
114b-Abbeville RL along LA Hwy 330	13	$15M	$11M	$17M	$336M	$275M	$405M	Yes	No
Abbeville RL (shortened variation)	6.5	$4M	$4M	$6M	$121M	$151M	$216M	No	No
146-Gueydan Ring Levee	6	$546K	$386K	$579K	$12M	$120M	$180M	No	No
409-Kaplan Ring Levee	11	$32K	$32K	$48K	$960K	$215M	$325M	No	No

Evaluation of Nonstructural Measures

The study has evaluated nonstructural measures that include structure elevation, dry flood proofing, wet flood proofing, detached flood proofing using berms and small walls, structure relocations, acquisition, building restrictions, and code enforcement. A detailed explanation of some of these measures is provided below.

Structure elevation is a common and widely applied nonstructural measure in the region and in the nation. Structure elevation is primarily focused on residential structures and implemented by private sector contractors, many of which have many years of experience. The technology used to implement structure elevation will be contingent upon the nature of the structure (foundation type, number of stories, exterior composition) and the nature of the soils, which is an important consideration in coastal Louisiana. Moreover, contractors typically specialize in one, or possibly more, structure elevation technology.

Dry flood proofing is a method of preventing flood water from entering the structure through the application of impermeable materials to the perimeter of the building and the placement of barriers at entrances. This approach is generally applied to nonresidential structures since the nature of the construction is more amenable to this type of retrofitting. While technically applicable to residential structures, the National Flood Insurance Program gives no credit to residential property owners for this method of flood mitigation for the purpose of determining flood insurance premiums, therefore leaving structure elevation as their primary financial incentive. Materials technology and techniques of application often vary, but the nature and scope of this approach to reducing flood risk is generally consistent from structure to structure. Dry flood proofing is effective for flood depths not greater than three feet above the adjacent ground.

In contrast, wet flood proofing consists of physically modifying the structure, except for its foundation, and the relocation of damageable items such that the interaction of the structure and flood water will result in less economic damage. The techniques applied for wet flood proofing can vary widely, is customized for each structure, and can only be determined by site inspection. Like dry flood proofing, there is a limit to its effectiveness, generally three feet of flood depth, although opportunities for performance of greater than three feet often are available depending upon individual circumstances.

Detached flood proofing employs berms and small walls engineered with a footprint that closely approximates the perimeter of the structure being protected. What distinguishes these features from local levees or ring levees is that they do not alter the hydrology of the flood plain and have no significant environmental impacts. Heights of these features range generally from 3 to 6 feet.

Structure relocation consists of the physical conveyance of a structure from its current location to another vacant parcel that has significantly reduced flood risk. The technology involved is reasonably straightforward, but not all structures are candidates for this type of measure as the footprint of the structure itself must be able to accommodate the capacity of the equipment needed to conduct the haul.

Acquisition as a nonstructural measure is more accurately described as acquisition of the structure and demolition of the structure. The implementation of property acquisition will be described in the Real Estate Plan. To complete this nonstructural measure, the structure thus acquired would be demolished to remove the asset from the flood plain and thereby entirely eliminate flood risk. The degree of engineering planning needed to execute demolition is limited and the techniques required to implement include the deployment of conventional, specialized, mobile construction equipment.

Although all of the nonstructural measures described above were are viable options for implementation and were considered, the evaluation of nonstructural measures included only those that relate to structure elevation, dry flood proofing, and acquisition. Subsequent investigations of nonstructural measures at a higher level of detail in future studies will include the full range of nonstructural measures as presented earlier.

Nonstructural Implementation Considerations

In formulating the nonstructural plan the PDT followed the guidance contained in the Memorandum from James F. Johnson, Chief, Planning and Policy Division, Directorate of Civil Works (22 January 2001), which provides changes to ER 1105-2-100 (April 2000) and IWR Report 88-R-2 (March 1988 pertaining to flood plain evacuation by relocation or acquisition/demolition for all projects proposed after the Water Resource and Development Act of 1999. Additional regulations that were considered include, but are not limited to, Executive Order 11988, "Floodplain Management" (24 May 1977) as amended (Jan. 2015); Federal Emergency Management Agency ("FEMA") Revised Guidelines for Implementing Executive Order 11988, Floodplain Management; EP 1165-2-314 "Flood Proofing Regulations" (15 Dec. 1995): ER 1165-2-26 "Implementation of Executive Order 11988 on Flood Plain Management" (30 March 1984); ER 1105-2-101 "Risk Analysis for Flood Damage Reduction Studies" (3 Jan 2006); EM 1110-2-1619 "Risk Based Analysis for Flood Damage Reduction Studies" (1 Aug 1996); Section 73 of the Water Resource and Development Act of 1974; and Section 219 of the of the Water Resource and Development Act of 1999.

A primary goal of the Nonstructural Plan is reduce flood risks for residential and non-residential structures that have first floor elevations at or below the 0-25-year floodplain, based on hydrologic conditions predicted to occur in 2025 (the beginning of the period of analysis). The Plan will provide reduced flood risk for a total of 4,952 total impacted structures comprised of 4,219 eligible residential structures, 396 eligible commercial structures and public buildings, and 337 eligible warehouses. The expected average annual net benefits are approximated at $231.6 million dollars, with $846,000,000 in first costs and a benefit/cost ration of 7.74:1. Eligible structures will require additional structure specific analysis during the preconstruction engineering and design ("PED") and construction phases to determine the best, most cost-effective measures to be employed for reducing flood risk. Consequently, each eligible structure will be inspected by a floodplain engineer, structural engineer, cost engineer, civil engineer, and real estate specialist to determine the type of nonstructural measure to be employed. The inspection of individual structures has not been performed at this stage of the Study.

Implementation of structure elevation is expected to be performed by private contractors consistent with the requirements outlined in the Real Estate Plan. Parish or community ordinances (building codes) articulate specific engineering requirements necessary to issue a permit for structure elevation and a certificate of occupancy once the elevation is completed. These ordinances must conform to the minimum flood plain management requirements as contained in Chapter 44 of the Code of Federal Regulations (44 CFR Part 60) as a condition of participation in the National Flood Insurance Program. Among those requirements is an elevation certificate issued by a licensed public engineer, and associated inspections by public officials related to the enforcement of electrical, plumbing, and other codes as utilities are reestablished.

In the implementation of structure elevation as a Federal project, the role of the non-Federal sponsor would include the review of plans and specifications provided by the private sector contractor as a condition of the flood mitigation agreement between the Corps, the non-Federal sponsor, and the property owner. The objective of the review of the plans and specifications is to ensure that they comply with existing engineering standards and regulatory guidance as presented in local ordinances, the Louisiana State Building Code, and 44 CFR Part 60.

Initial Focused Array of NED Alternatives

Based on the PDT's assessment of the evaluation of the intermediate array six structural plans were identified for the focused array and more detailed analysis. The PDT also determined from initial evaluations that a programmatic non-structural risk reduction plan was viable. Based on the screening conclusions, the focused array of action alternative plans includes the following:

0. No action
1. Lake Charles ring levee ("Eastbank" Feature 149)
   - southern/eastern ring only
2. Lake Charles ring levee ("Westbank Sulphur South" Feature 149)
   - southern/western ring only
3. Lake Charles ring levee ("Westbank Sulphur Extended" Feature 411/412)
   - northern/west ring only
4. Abbeville ring levee along LA Hwy 330 ("Abbeville to Delcambre" Feature 114b)
5. Delcambre, Erath and vicinity levee alignment (Feature 513)
6. Abbeville levee (shortened variation)
7. Nonstructural Plan (Nonstructural Justified Reaches)
8. Nonstructural Plan (Nonstructural 100-Year Floodplain)

Net Benefits Analysis of NED Focused Array & Elimination of all Structural NED alternatives

The Table below summarizes the net benefits of the structural alternatives, as well as the benefits for the 100-year level of risk reduction nonstructural alternatives. The two nonstructural plans considered any structure with a FFE below the 2075 100-year (1% ACE) stage. This was done to correspond with FEMA regulations that require new development to FFE higher than the 100 year (1% ACE) floodplain.

Net NED benefits.

Alternatives	50 year (Mil $)	100 year (Mil $)	200 year (Mil $)
Plan 1: Lake Charles Eastbank#	1.9	6.8	6.9
Plan 2: Lake Charles Westbank Sulphur Extended	-5.0	-5.2	-8.4
Plan 3: Lake Charles Westbank Sulphur South	-17.7	-20.4	-25.5
Plan 4: Delcambre/Erath	-4.4	-5.8	-8.5
Plan 5: Abbeville to Delcambre	-8.4	-7.3	-11.1
Plan 6: Abbeville	-10.3	-8.2	-10.2
Plan 7: Nonstructural -Justified Reaches Plan	N/A	4.3	N/A
Plan 8: Nonstructural - 100-Year Floodplain Plan	N/A	-64.3	N/A

The assessment of economic feasibility for six independent structural measures was conducted in the focused array analysis. Initial results of the assessment show that only one structural alternative economically justified: the Lake Charles Eastbank Levee Alternative, Plan 1. With mitigation costs of approximately $100,000,000 included for each alternative, the 100-year (1% ACE) level of risk reduction yielded a benefit/cost ratio of 1.01 and the 200-year (0.5% ACE) level of risk reduction yielded a benefit/cost ratio of 1.04 (adding the mitigation costs made the 50-year (2% ACE) level of risk reduction not economically justified).

In addition, prior to the completion of the initial draft report additional assessment of the 100-year (1% ACE) and 200-year (0.5% ACE) Lake Charles levee alignments was conducted to evaluate the potential for any other viable levee design scales (75-year (1.5% ACE), 125-year (0.8% ACE). This additional investigation exposed an anomaly in the structure inventory database. The structure inventory used to calculate benefits for this alternative was modified to adjust the first-floor elevation for a single commercial structure that was incorrectly placed within the 100-year (1% ACE) floodplain. This structure would otherwise account for an unusually high percentage of damages and benefits in initial evaluations. Once this adjustment was completed, the benefit/cost ratio for Plan 1 fell to 0.61 for the 100-year (1% ACE) level of risk reduction and to 0.30 for the 200-year (0.5% ACE) level of risk reduction. **As a result of this additional evaluation, none of the structural levee alignments were found to be economically justified and none were carried into the final array.**

Nonstructural NED Plans considered in the draft 2013 Report.

The evaluation of the focused array determined that the most cost-effective solution to reduce hurricane and storm surge flood-risk within the study area is through nonstructural measures. Two alternative nonstructural plans plus the No Action Plan were carried forward for the NED final array. Plan 7 "Nonstructural - Justified Reaches Plan" was based on only the 11 economically justified reaches. Plan 8 "Nonstructural - 100-year Floodplain Plan" was considered to represent a potentially reasonable alternative based on the incremental presence of relatively high flood risk structures (100-Year floodplain) that exist throughout the study area irrespective of location within a defined reach. Plan 7 applied nonstructural measures (i.e. structure raising, flood-proofing, and property buy-outs) to structures within the 11 justified reaches and consisted of elevation of existing residential structures or acquisition of properties that require significant elevation, and flood proofing measures for non-residential structures for at-risk properties within the 2075, 100-year (1% ACE) floodplain. The initial basis for the selection of Plan 7 as the original TSP was the number of structures and cost identified in the 11 justified reaches. The preliminary estimated cost of Plan 7 as presented in the initial draft report is $388,000,000 for nonstructural measures benefiting 3,915 structures.

Selection of the current NED TSP.

After the release and receipt of comments on the December 2013 Initial Draft Report, structures in the 0-10-year floodplain were added to the structure inventory and additional economic calculations were performed to determine whether the addition of these repetitive flood risk structures resulted in a positive net NED benefits and has a positive benefit/cost ratio. The revised evaluation of nonstructural measures consisted of evaluating every structure in the revised inventory, with a FFE below the 100-year stage for water surface elevations (WSEs) prevailing in the year 2025 rather than the year 2075. Warehouses were also added to the structure inventory for benefit evaluation where small berms of floodwalls less than 6 ft in height represented the most appropriate nonstructural measure to reduce flood risk. Structures located in between the 0-25-year flood zones were deemed to be exposed to the highest level of flood risk and were considered the first increment. The second increment consists of structures with FFEs higher than the 25-year stage, but lower than or equal to the 50-year stage. The third increment encompasses all remaining structures located within the 100-year floodplain. The **new TSP** (**Modified Plan 8**) as recommended in this Report replaces in its entirety, the previous TSP (Plan 7) as set forth in the December 2013 Initial Draft Report.

To the maximum extent practicable, implementation of the Program will target willing participants and will be implemented as a voluntary program. However, for properties that meet certain criteria, eminent domain authority will be utilized when warranted. Eminent domain is the power of the government to take private property for public purposes with payment of just compensation. The Nonstructural Program will include:

1) Voluntary participation by residential and non-residential property owners of eligible structures that are in the 0-25-year floodplain.

2) Participation by local governments in administrative measures that support the NFIP (i.e. floodplain management, education programs, etc.); and

3) Involuntary acquisition of certain structures through eminent domain as further described herein.

NED Tentatively Selected Plan

The following nonstructural measures are included in the current NED TSP:

1. Elevation of eligible residential structures. The term "Base Flood" is defined by the National Flood Insurance Program (NFIP) as the "flood having a 1% chance of being exceeded in any given year and is also called the 100 year flood". For the purposes of this Study this base flood elevation has been forecast into the future based on anticipated hydrologic conditions in the year 2075. This measure requires lifting the entire structure or the habitable area to the predicted 2075, 100-year base flood elevation unless the required elevation is greater than a maximum of 13 feet above ground level.

2. Dry flood proofing of eligible non-residential structures. Dry flood proofing consists of sealing all areas below the flood protection level of a structure to make it watertight and ensure that floodwaters cannot get inside by making walls, doors, windows and other opening impermeable to water penetration. Walls are coated with sealants, waterproofing compounds, or plastic sheeting is placed around the walls and covered, and back-flow from water and sewer lines prevention mechanisms such as drain plugs, standpipes, grinder pumps and back-up valves are installed. Openings, such as doors, windows, sewer lines and vents, may also be closed temporarily, with sandbags or removable closures, or permanently. Dry flood proofing achieves flood risk reduction but it is not recognized by the NFIP for any flood insurance premium rate reduction when applied to residential structures, and may not be used under the NFIP for new or substantially damaged buildings located in a Special Flood Hazard Area. Based upon National Flood Proof Committee sponsored tests at the Engineering Research and Development Center ("ERDC"), a "conventional" built structure can generally only be dry flood proofed up to 3 feet on the walls. A structural analysis of the wall strength is required to achieve higher protection. Closure panels may be used at openings. This measure is viable for appropriate structures in the study area if design flood depths are generally less than three feet, and hydrodynamic forces would also be a consideration. For structures with crawlspaces, the only effective way to dry flood proof is to make the first floor impermeable to the passage of floodwater.

3. Construction of flood proofing barriers or berms less than 6 feet in height around primarily industrial complexes and warehouses. These measures are intended to reduce the frequency of flooding but not eliminate floodplain management and flood insurance requirements. Barriers or berms can be constructed of earth, concrete, masonry or steel and placed around a single structure or a contiguous group of structures. It should be noted that some local governments may have adopted floodplain management rules that exceed the minimum requirements of the NFIP, and may limit the ability of certain flood-proofing measures to be constructed if effects of the flood-proofing measure (i.e., small berms, barriers, or floodwalls) create the potential for drainage problems by displacing flood storage, elevating buildings on fill, requiring significant tree removal, etc.

4. Floodplain Management Plans. The NFS for the SWC Project is required to prepare a Floodplain Management Plan (FPMP) in coordination with USACE to maintain the integrity of the USACE Project. The NFS should use best efforts to work with the governing bodies within the three parishes to ensure consistency with local development plans and regulations across the Study Area. If the FPMP is prepared during the feasibility phase of the study, the costs of preparing the FPMP can be cost-shared on the same basis as the feasibility study. By integrating the FPMP with the feasibility

study, both the FPMP and the ultimate project are bettered, and therefore it is recommended that the FPMP be prepared within this Feasibility Study.

5. Adoption of more stringent local floodplain regulations. Floodplain regulation and floodplain management are based in the NFIP which requires minimum standards of floodplain management and floodplain regulation for participating communities. Although communities within the SWC study area cannot change the minimum NFIP standards, local governments can adopt local standards that achieve higher levels of flood risk reduction, such as:
   - Replace elevation requirements based on the 100-year to the 500-year;
   - Implement a zero rise floodway; and
   - Adopt cumulative damages as the trigger for substantial damage determination.

6. Adoption of more restrictive parish and municipal building codes, land use & zoning regulations and other developmental controls. Local governments within the floodplain should be encouraged to stricter building and housing code requirements, and land use and zoning regulations and other developmental controls aimed at reducing flood risk and flood damage. Examples include, restrictions on where new development may occur, minimum elevations for habitable first floors, requiring suitable anchorage to prevent flotation of buildings during floods; establishing minimum protection elevations for the first floors of structures; requiring electrical outlets and mechanical equipment to be above regulatory flood levels or be appropriately flood-proofed; restricting the use of materials that deteriorate when wetted; requiring adequate structural designs that can withstand the effects of water pressure and flood velocities; requiring the repair of flood- damaged structures in a manner that will ensure the safety of occupants and prevent blight.

NER PLAN FORMULATION

NER Goal: Provide ecosystem restoration to achieve ecosystem sustainability.

Problems	Opportunities	Objectives	Measures
Increased flood durations in wetlands (resulting in wetland loss)	Add or modify water control and/or drainage structures.	Objective 2. Improve hydrologic connectivity of wetlands to prevent scouring and loss of wetland soils and reduce storm surge-deposited saltwater residency time. Objective 3. Reduce flooding in non-flotant fresh and intermediate marshes during the vegetation growing season (March – September).	Hydrologic and salinity control structures or operational changes.
Erosion of channel banks and shorelines (resulting in wetland loss)	Stabilize navigation channel banks, lake rims, and coastal shorelines.	Objective 4. Reduce erosion of canal banks and shorelines in critical areas to protect adjacent wetlands.	Marsh Bank and shoreline stabilization features (breakwaters, riprap, dunes vegetative plantings, artificial reefs)
Deforestation and mining of chenier ridges and oyster beds.	Stop sand mining and restore chenier and oyster habitat.	Objective 5. Restore critical geomorphologic features, such as marshes and cheniers, to maintain their function as wildlife habitat and as protective barriers to inland areas.	Replant chenier ridges with native trees. Re-seed oyster beds.
Wetland loss	Restore wetland habitat.	Objectives 2 – 5 listed above.	Marsh creation, terracing, plantings.

Features were initially assembled from these existing studies:

1. LACPR Planning Unit 4 Coastal Restoration Plan
2. 2007 State Master Plan Coastal Restoration Plan

These plans were dissected into individual features and features were added from other sources (parish plans, NEPA scoping, interagency PDT). NER measures are categorized by Measure type and by basin in the following set of tables.

Table C-5: Hydrologic and Salinity Control Measures

Basin	ID	Feature Name
Calcasieu-Sabine Basin	7	Salinity control structures in Calcasieu Ship Channel near Ferry/at the Gulf of Mexico
	48	Salinity Control Structure at Sabine Pass
	407	Structure on GIWW at Gum Cove Ridge
	17a	Salinity control structure on Alkali Ditch
	17b	Salinity control structure on Crab Gully
	17c	Salinity control structure on Black Lake Bayou near Hackberry (Kelso Bayou)
	74a	Need spillway structures at East Calcasieu Lake
Mermentau Basin	74b	Need spillway structures at Humble Canal
	74c	Need spillway structures North of Deep Lake
	13	Freshwater introduction/retention structure or sill on Little Pecan Bayou
	21a	Hydraulic Improvements in Mermentau Basin at Highways 82 and 27: East of Calcasieu Lake (Big Burn)
	21b	Hydraulic Improvements in Mermentau Basin at Highways 82 and 27: South of Grand Lake (Little Pecan Bayou Hydrologic Restoration)
	21c	Hydraulic Improvements in Mermentau Basin at Highways 82 and 27: South of White Lake (South Pecan Freshwater Introduction)
Teche-Ver.	304a	Southwest Pass Sills - Southwest portion
	304b	Southwest Pass Sills – Northeast portion
	507	Reef like feature from Dead Cypress Point (Near Cypremort Point) to NW corner of Marsh Island
	508	Reef like feature from Maroon Point to Lake Point (Marsh Island)
	603	Control structure at Tom's Bayou
All	602	Operational changes to existing structures (not on map)

The initial set of chenier measures included all cheniers and elevated features identified by the Providence Engineering, Chenier and Natural Ridges Study (2009) and are presented in the table below.

Table C-6, Preservation/Restoration of Unique Natural Features (Oyster Reefs & Chenier Ridges) Measures

Basin	Subunit	ID	Feature Name/Description
Calcasieu-Sabine	Sabine Lake	604	**Preservation of Sabine Historic Oyster Reefs**
	038 – Sabine Ridges	510a	**Blue Buck Ridge** - Eight tracts totaling approximately 524 acres were identified.
		510b	**Hackberry Ridge** - Three tracts totaling approximately 149 acres were identified. The western two miles (including the 63 acre tract) of this measure have been identified by the Louisiana Natural Heritage Program as "Remnant Chenier Forest", but appear to have been damaged by recent hurricanes.
	009 – Cameron-Creole Front Ridge	510d	**Front Ridge** - In general, the eastern 3 miles of this measure do not encompass large swaths of suitable elevation. Of the remainder, eleven tracts totaling approximately 459 acres were identified.
Mermentau	061- Grand Chenier Ridge	416	**Grand Chenier Ridge** - In general, the eastern 6 miles of this measure do not encompass large swaths of suitable elevation. Of the remainder, nine tracts totaling approximately 252 acres were identified.
Teche-Vermilion	091 – East Freshwater Bayou/Cheniere au Tigre Bayou	509c	**Bill Ridge** - Three tracts were indentified that encompass approximately 9 acres of the northern ridge, and roughly 7 and 6 acres of the southern ridge. The middle section of the southern ridge was excluded due to insufficient elevation.
		509d	**Cheniere Au Tigre** - The majority of this chenier is currently forested with the exception of an 8 acre tract on the western end. The eastern part of the measure along the Gulf shoreline was screened out due to concerns about the sustainability of tree plantings in these exposed areas.

Table C-7, Marsh Restoration Measures

Basin	ID	Feature Description	Project Area
Calcasieu-Sabine	3a1	Black Lake marsh restoration	597 ac
	3c1	Cameron-Creole marsh restoration	2,147 ac
	3c2		1,137 ac
	3c3		1,322 ac
	3c4		1,016 ac
	3c5		3,389 ac
	124a	Mud Lake marsh restoration	1,102 ac
	124b		341 ac
	124c		2,658 ac
	124d		623 ac
	135a	Sweet/Willow Lake marsh restoration	1,620 ac
Mermentau	127c1	Marsh restoration at East Pecan Island on west side of Freshwater Bayou	1,176 ac
	127c2		1,300 ac
	127c3		894 ac
	47a1	Terracing south of Highway 82	889 ac
	47a2		1,562 ac
	47c1		984 ac
	47c2		1,199 ac
	47f	Terracing south of Highway 82	809 ac
	47h	Terracing south of Highway 82	1,520 ac
Teche-Vermilion	306a1	Rainey Marsh Restoration	2,089 ac
	306a2		2,476 ac
	306b1		1,245 ac
	306b2		1,371 ac
	306b3		2,233 ac

Table C-8, Shoreline/Bankline Stabilization Measures

Basin	ID	Feature Description	Project Length
Calcasieu-Sabine	49b1	Shoreline protection for Calcasieu Lake/ Cameron-Creole levee	77,253 lf
	5a	Holly Beach shoreline	39,445 lf
Mermentau	6b1	Gulf shoreline of Rockefeller NWR	58,707 lf
	6b2		42,805 lf
	6b3		37,911 lf
	16b (west)	Freshwater Bayou – unprotected portions of west bank	48,123 lf
Teche-Vermilion	16b (east)	Freshwater Bayou –unprotected portions on east bank	72,817 lf
	99a	Gulf shoreline protection in front of Cheniere Au Tigre ridge	9,235 lf
	113b2	Vermilion Bay shoreline: Southwest section	42,473 lf

Initial Screening of NER Measures

NER features were next screened by measure type across the entire study area.

Chenier Reforestation Measure Screening - To identify the most critical/strategic cheniers or segments of cheniers to reforest, the implementability and sustainability of the project was considered. Areas were deemed unsuitable for reforestation and were screened out for the following reasons:

- Low elevation. Unsuitable due to poor soil drainage and potential exposure to high salinities.
- Shoreline erosion. Areas exposed to high rates of shoreline erosion unsustainable.
- Forested areas. Areas with existing canopy cover would not benefit from reforestation.
- Developed areas. The presence of roads, homes, utilities, or oil and gas infrastructure, etc. restricts reforestation efforts.

Pecan Island Ridge (Measure 509a) was screened out because Pecan Island ridge is densely developed with no large (>5 acres) tracts available for reforestation. Mulberry Ridge (509b) and Belle Isle Ridge (509e) was screened out because elevations are less than +5 feet NAVD 88 and are unsuitable for reforestation to achieve long-term sustainability. Hackberry Beach Ridge (510c) was screened out because the only area with sufficient elevation is immediately adjacent to the beach, and tree plantings would not be sustainable in that location.

Cheniers carried forward included Grand Chenier Ridge (Measure 416), Bill Ridge (Measure 509c), Cheniere au Tigre Ridge (509d), Blue Buck Ridge (510a), Hackberry Ridge (510b), and Front Ridge (510d). These sites were further divided into 35 reforestation tracts totaling approximately 1,413 acres.

Hydrologic & Salinity Control Measure Screening – Modeling performed for the 2012 State Master Plan showed that some H&S control features had only modest or little benefits (see Figure C-1). Measures benefiting less than 500 acres were screened out. Some H&S control measures work together. See Table C-9 below.

Table C-9, Hydrologic & Salinity Control Measure Screening Summary

ID	Feature Name	Conclusions
7	Salinity control structures in Calcasieu Ship Channel near Ferry/at the Gulf of Mexico	These measures work as a unit for exterior perimeter control and preclude the need for Alkali Ditch/Crab Gully/Kelso Bayou, GIWW at Gum Cove Ridge (407), and East Calcasieu Lake (74a).
48	Salinity Control Structure at Sabine Pass	
407	Structure on GIWW at Gum Cove Ridge	
17a	Salinity control structure on Alkali Ditch	These three measures work as a unit (do 17a, 17b, and 17c together).
17b	Salinity control structure on Crab Gully	
17c	Salinity control structure on Black Lake Bayou near Hackberry (Kelso Bayou)	
74a	Need spillway structures at East Calcasieu Lake	
74b	Need spillway structures at Humble Canal	Screened out <500 acres (see figure C-1)
74c	Need spillway structures North of Deep Lake	Screened out <500 acres (see figure C-1)
13	Freshwater introduction/retention structure or sill on Little Pecan Bayou	
21a	Hydraulic Improvements in Mermentau Basin at Highways	Screened out because structure already constructed

ID	Feature Name	Conclusions
	82 and 27: East of Calcasieu Lake (Big Burn)	there under the CWPPRA authority.
21b	Hydraulic Improvements in Mermentau Basin at Highways 82 and 27: South of Grand Lake (Little Pecan Bayou Hydrologic Restoration)	Screened out <500 acres (see figure C-1)
21c	Hydraulic Improvements in Mermentau Basin at Highways 82 and 27: South of White Lake (South Pecan Freshwater Introduction)	Screened out <500 acres (see figure C-1)
304a	Southwest Pass Sills - Southwest portion	Screened out <500 acres (see figure C-1)
304b	Southwest Pass Sills – Northeast portion	Screened out <500 acres (see figure C-1)
507	Reef like feature from Dead Cypress Point (Near Cypremort Point) to NW corner of Marsh Island	Screened out because (1) the Louisiana State Master Plan showed only modest benefits for these measures (2) the measures are outside the study area (3) these measures may be constructed with Oil Spill Restoration dollars.
508	Reef like feature from Maroon Point to Lake Point (Marsh Island)	Screened out for same reasons as 507 above.
603	Control structure at Tom's Bayou	Screened out <500 acres (see figure C-1)
602	Operational changes to existing structures (not on map)	Still a possible measure.

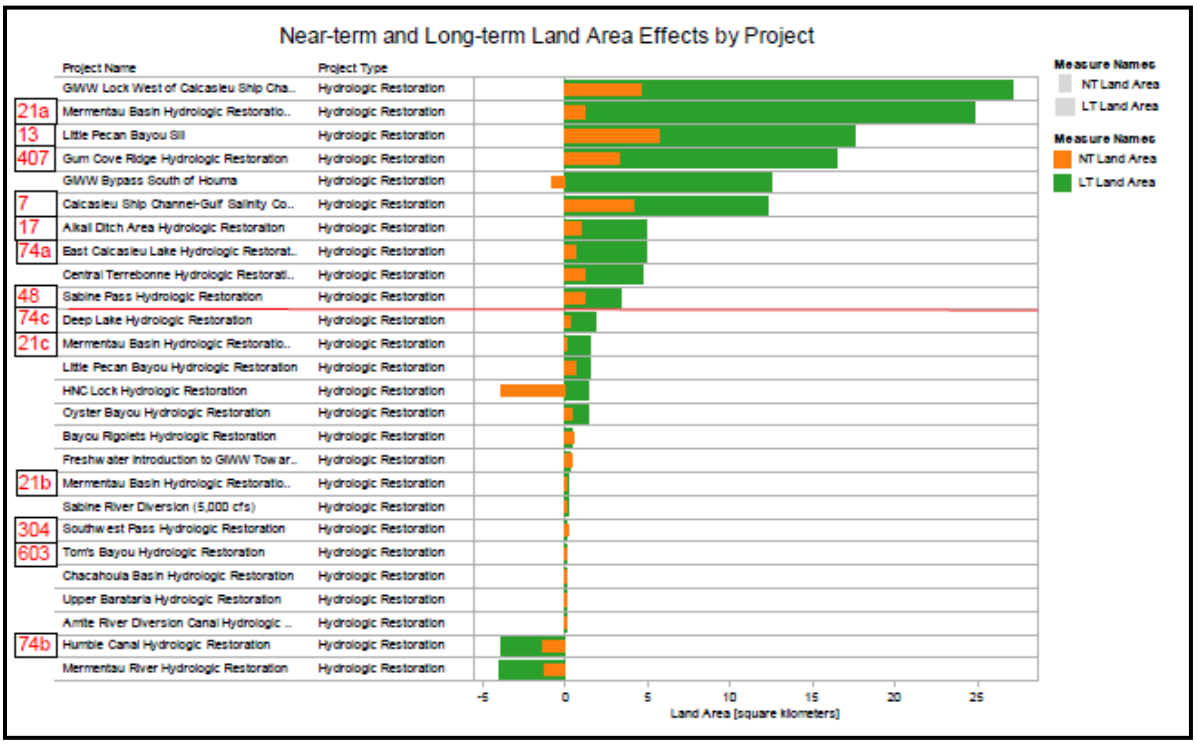

Figure C-1. State Master Plan Modeling Results used for H&S measure screening.

Marsh Restoration Measure Screening – Started with proposed marsh restoration for eight geographic locations across the study area. Divided these large marsh restoration areas into 29 individual measures/sites ranging in size from hundreds of acres to thousands of acres, totaling over 40,000 acres (refer to table NER1 for more details). Five measures/sites were screened out for the following reasons:

- Two of the Black Lake sites (Measures 3a2 and 3a3) were screened out because the areas are already permitted for use by a liquid natural gas company (SEMPRA).

- The Commissary Point site (Measure 3d) was screened out because it was found to be the least efficient marsh restoration measure. Its cost per net acre is over five times that of the most efficient marsh restoration measure. The measure is located in Subunit 45, which is gaining at a rate of +0.021%/year. It was gaining prior to Hurricane Rita at a rate 0.396%/year so the hurricane did have an impact, just not enough to convert the area to a loss trend. Based on this information, it appears that the marsh in this area will rebound on its own.

- One of the two Sweet/Willow Lake sites (Measure 135b) was dropped because of sustainability issues. The depth near 135b is likely greater than 2 feet. Terracing projects in this area have failed in the past because of high subsidence rates.

Table C-10: Marsh restoration measure attributes and screening summary.

Site	ID	Total Acres*	First Cost ($Million) **	Effectiveness: Net Acres***	Efficiency: Cost/Net Acre	In or out?	Comments and/or Screening Rationale
Black Lake	3a1	597	$20.4	545	$37,431	In	Based on the recent Black Lake project, cost estimate may be too low if the area is deeper than estimated. Potential synergy with any proposed hydro/salinity control measures that would prevent saltwater intrusion in the area. Synergy with other beneficial use projects in the Black Lake area.
	3a2	1,465	$40.5	1,271	$31,865	**Out**	Measures 3a2 and 3a3 were screened out because the areas are already permitted for use by LNG company (SEMPRA).
	3a3	490	$15.3	465	$32,903	**Out**	
Cameron-Creole	3c1	2,147	$43.7	1,333	$32,783	In	The Calcasieu Lake rim is considered a critical landscape feature. These marsh creation measures help preserve the outer lake rim and have synergy with proposed shoreline stabilization measure 49b1 which helps preserve the inner lake rim and hydrologic/salinity control levee. These measures are also located within or adjacent to the Cameron Prairie National Wildlife Refuge.
	3c2	1,137	$31.8	808	$39,356	In	
	3c3	1,322	$36.9	999	$36,937	In	
	3c4	1,016	$28.3	771	$36,706	In	
	3c5	3,389	$80.8	2,412	$33,499	In	

Site	ID	Total Acres*	First Cost ($Million) **	Effective-ness: Net Acres***	Efficiency: Cost/Net Acre	In or out?	Comments and/or Screening Rationale
Commissary Point	3d	399	$13.0	73	$178,082	**Out**	Measure 3d is the least efficient marsh restoration measure. Its cost per net acre is over five times that of the most efficient marsh restoration measure. The measure is located in Subunit 45, which is gaining at a rate of +0.021%/year. It was gaining prior to Hurricane Rita at a rate 0.396%/year so the hurricane did have an impact, just not enough to convert the area to a loss trend. Based on this information, it appears that the marsh in this area will rebound on its own.
S. of Hwy 82	47a1	889	$41.9	827	$50,665	In	Measure 47h may be built with CGBG funds. Measures 47f and h were reclassified as marsh creation, and then subsequently dropped because we decided to select marsh creation measures that would best reinforce critical landscape features, with particular emphasis on areas that are exposed to saltwater, tidal and wave action because it is critical to introduce new sediment to these areas to increase wetland sustainability. 47f and h are not exposed to high salinities as much as the other marsh creation areas selected.
	47a2	1,562	$67.2	1,362	$49,339	In	
	47c1	984	$45.3	930	$48,710	In	
	47c2	1,199	$58.2	1,176	$49,490	In	
	47f	809	$38.7	789	$49,049	**Out**	
	47h	1,520	$58.4	516	$113,178	**Out**	
Mud Lake	124a	1,102	$35.8	820	$43,659	In	These measures are all relatively efficient with the exception of measure 124d; however, 124d is critical because it reinforces the West Cove lake rim which is a critical landscape feature. Most of measure 124d is located either within or adjacent to the Sabine NWR. Measure 124a is also part of the Sabine National Wildlife Refuge and is adjacent to Hwy 27. Measure 124c is adjacent to Hwy 27 and would have synergy with measure 5a.
	124b	341	$12.4	248	$50,000	In	
	124c	2,658	$71.6	1,778	$40,270	In	
	124d	623	$13.8	159	$86,792	In	
Pecan Island	127c1	1,176	$41.7	648	$64,352	In	The 127 measures are critical to preventing further degradation to the wetlands to the west of Freshwater Bayou. They would also have synergy with existing and proposed Freshwater Bayou stabilization measures.
	127c2	1,300	$61.2	1,182	$51,777	In	
	127c3	894	$28.4	370	$76,757	In	
Sweet/	135a	1,620	$28.0	663	$42,232	**Out**	Not in a critical area for marsh creation (i.e. salinities are relatively low in this location).
	135b	2,146	$71.5	1,699	$42,084	**Out**	Measure 135b was dropped because of sustainability issues. The depth near 135b is likely greater than 2 feet. Terracing projects in this area have failed in the past because of high subsidence rates.
Ra in	306a1	2,089	$52.2	631	$82,726	In	Measures 306b1-3 were screened out because

Site	ID	Total Acres*	First Cost ($Million) **	Effective-ness: Net Acres***	Efficiency: Cost/Net Acre	In or out?	Comments and/or Screening Rationale
	306a2	2,476	$74.7	1,309	$57,066	In	the portion of Freshwater Bayou bank that is adjacent to them is relatively solid and protected by rock.
	306b 1	1,245	$35.5	408	$87,010	**Out**	
	306b 2	1,371	$40.3	574	$70,209	**Out**	
	306b 3	2,233	$52.0	623	$83,467	**Out**	

*Total wetland acres to be constructed by proposed measure.
** Rounded to nearest 100,000.
***Net acres over the period of analysis. Land change rates used to calculate net acres based on USGS hyper-temporal analysis.

Shoreline Protection Measure Screening – Approximately 1.9 million linear feet (or 360 miles) of bank and shoreline stabilization measures were evaluated. Of the approximately 30 bank/shoreline features evaluated, 20 were screened out for the following reasons:

- All four of the Grand Lake features (features 12a – 12d) were screened out. Two of the features produced zero benefits. The other two features were not very effective or efficient (cost/net acre 2 to 4 times the average).
- Schooner Bayou (feature 16a) was not very effective or efficient (cost/net acre 4 to 5 times the average).
- It was not cost effective to rock the entire length of the GIWW (feature 26). Shoreline stabilization may be considered as part of measures located adjacent to the GIWW (e.g. Marsh Restoration features 3a1) if required by field conditions.
- Although West Cove is an important lake rim because of its proximity to Hwy 27 and the Sabine National Wildlife Refuge, the 49a features are not very cost efficient or effective in terms of net acres. The area most at risk in the future without project condition can be more cost effectively protected by marsh restoration feature 124d.
- The Lake Calcasieu features were dropped because there were either not effective (49b1 benefited limited to levee protection) or not efficient (49b2 cost/net acre 3 times the average).
- Four of the five Vermilion Bay features were screened because of low effectiveness/efficiency. For example, feature 113a2 was screened out because shoreline loss rates are low (2.6 ft/yr) resulting in low efficiency. Although over 100 net acres could be preserved, a shoreline stabilization feature would not be effective in reducing interior wetland loss.
- All of the Southwest Past (303's) and Freshwater Bayou (606's) measures were screened because they were not effective or efficient.

Table C-11: Bank/Shoreline protection feature attributes and screening summary.

Site	ID	Total Length (feet)	Cost ($Million)	Effectiveness: Net Acres	Efficiency: Cost/Net Acre	In or out?	Comments and/or Screening Rationale
Holly Beach	5a	39,445	$43.0	870	$49,409	In	Critical protection for Holly Beach community and Hwy 27. Synergy with marsh measure 124c.
Rocke-feller	6b1	58,707	$80.6	3,395	$23,726	In	Critical protection for the Rockefeller Wildlife Refuge. Synergy with CWPPRA project ME-18. Soil/foundation concerns are currently being analyzed through demonstration projects.
	6b2	42,805	$58.9	2,638	$22,316	In	
	6b3	37,911	$52.3	1,640	$31,864	In	
Grand Lake	12a	11,491	$5.9	0	N/A	**Out**	Measures 12a and 12b don't meet objectives because they produce zero benefits.
	12b	1,240	$3.3	0	N/A	**Out**	
	12c	13,138	$6.2	29	$214,916	**Out**	Not effective – the combined benefits of 12c and 12d are less than 100 net acres. Not efficient – Cost/net acre 2 to 4 times the average.
	12d	45,248	$21.4	59	$362,497	**Out**	
Schooner Bayou	16a	20,317	$14.2	29	$488,244	**Out**	Not effective – less than 30 net acres. Not efficient - Cost/net acre 4 to 5 times the average.
Freshwater Bayou	16b-west	~ 150,000	$16.5	181	$91,160	In	Freshwater Bayou and surrounding marshes are critical landscape features. From an indirect benefits perspective, on the east bank there is a greater area of potentially vulnerable wetlands behind the southern part as compared to the northern part.
	16b-east (N)		$13.0	121	$107,438	In	
	16b-east (S)		$32.5	450	$72,222	In	
GIWW	26	960,079	$488.0	1,958	$249,212	**Out**	Not cost effective to rock the entire length of the GIWW. Shoreline stabilization may be considered as part of measures located adjacent to the GIWW (e.g. Marsh Measure 3a1) if required by field conditions.
West Cove	49a1	33,839	$18.4	87	$211,874	**Out**	Although West Cove is an important lake rim because of its proximity to Hwy 27 and the Sabine National Wildlife Refuge, the 49a measures are not very cost effective or effective in terms of net acres. The area most at risk in the future without project condition can be more cost effectively protected by marsh restoration measure 124d.
	49a2	36,701	$20.0	107	$186,534	**Out**	

Site	ID	Total Length (feet)	Cost ($Million)	Effectiveness: Net Acres	Efficiency: Cost/Net Acre	In or out?	Comments and/or Screening Rationale
Lake Calcasieu	49b1	82,282	$41.4	402	$102,934	**Out**	Benefits mostly limited to levee protection.
	49b2	151,249	$31.0	90	$344,714	**Out**	Not effective or efficient.
Cheniere au Tigre	99a	9,235	$7.2	86	$83,359	In	Part of the Cheniere au Tigre State Park. Despite producing less than 100 net acres, measure retained because Cheniere au Tigre is a critical landscape feature and shoreline stabilization is critical to protecting the Cheniere au Tigre reforestation measure.
Vermilion Bay	113a1	16,085	$11.6	46	$252,671	**Out**	Not efficient or effective.
	113a2	65,728	$46.1	185	$249,027	**Out**	Screened out because shoreline loss rates are low (2.6 ft/yr) resulting in low efficiency. Although over 100 net acres could be preserved, shoreline stabilization measure would not be effective in reducing interior wetland loss.
	113a3	N/A	N/A	N/A	N/A	**Out**	Measure was reformulated to remove sections located outside of the study area. The remaining portions within the study area were found to be stable.
	113b1	52,845	$37.1	288	$128,940	**Out**	Below average efficiency.
	113b2	42,473	$29.8	282	$105,630	In	Measure may be shortened to improve efficiency and protect the most vulnerable portion of the marsh.
Southwest Pass	303a1	6,953	$4.1	15	$275,526	**Out**	Not effective or efficient.
	303a2	31,434	$17.2	79	$217,643	**Out**	
	303b1	9,288	$5.4	18	$299,819	**Out**	
	303b2	17,353	$9.7	55	$175,864	**Out**	
Freshwater Bayou	600a	1,980	$2.0	14	$146,346	**Out**	Not effective or efficient.
	600b	4,165	$3.9	14	$276,155	**Out**	
	600c	5,241	$4.8	10	$481,053	**Out**	

Completion of the NER Formulation Process

The combination of the remaining features to develop a focused array of NER alternatives is described in Chapter 2, Plan Formulation, of the Main Report. Also fully documented in Chapter 2 is the comparison of the NER focused array, selection of the final array of alternative plans, and the identification of the NER Tentatively Selected Plan. Public, technical, and policy comments received following release of the initial draft feasibility report supported a modification of the implementation considerations for the NER TSP to allow for a full construction recommendation to be submitted. Details of the revisions made to allow this change in the TSP are also included in Chapter 2, Plan Formulation, of the Main Report.